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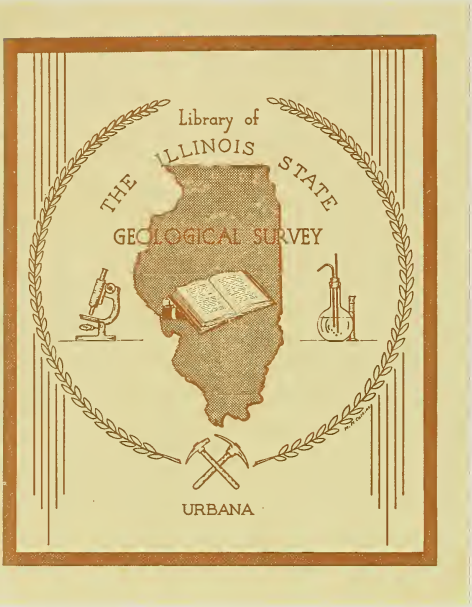

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GEOLOGY AND PALEONTOLOGY OF LATE PLEISTOCENE LAKE SALINE, SOUTHEASTERN ILLINOIS

John C. Frye, A. Byron Leonard, H. B. Willman, and H. D. Glass

ABSTRACT

Lacustrine deposits and lake-modified terrane cover extensive areas in southern Illinois where late Pleistocene lakes were dammed behind glacial outwash fills in the Ohio and Wabash Valleys. In the Saline River Basin, Lake Saline extended into parts of five counties and occupied the low areas of the basin. The lake left behind as much as 150 feet of sediments that cover the lowland and surround many bedrock hills that formerly existed as islands. The lake deposits, which are all Wisconsinan in age, extend across the southern limit of Illinoian glaciation. The earliest lake fill (Altonian) consists of silty clay from a northern outwash source. During subsequent Farmdalian time there were shallow soil development and deposition of gleyed clays. The Woodfordian witnessed the greatest extent of the lake, the deposits of which underlie most of the flat and relatively undissected lake plain at elevations of 375 to 400 feet. Early Woodfordian molluscan faunas indicate that the lake was cool and open; radiocarbon dates confirm the age of the mollusks. Clay-mineral compositions indicate that much of the fine-textured sediment was transported to the lake as outwash from the northeast. Following draining of the extensive early Woodfordian lake there were several episodes of stream incision and valley alluviation in the Ohio and Wabash Valleys that caused later but less extensive lake stages in the Saline Basin. These lower-level stages of Lake Saline resulted in localized deposits that contain abundant lacustrine molluscan faunas. In erosional valleys cut into the western part of the lake plain, locally derived clayey lacustrine silt accumulated. The latest lacustrine deposits and faunas are dated at about 13,000 radiocarbon years B. P. Overwash deposits of locally derived clayey silt have veneered many areas of the lake-plain surface, particularly in the tributary valleys.

INTRODUCTION

In large parts of Gallatin, Saline, and adjacent counties in southeastern Illinois, land-use is importantly influenced by the character and topography of late Pleistocene lake deposits. These deposits bury large areas of the bedrock surface and form a widespread, flat, poorly drained plain, which is underlain by thick clays and silts. The body of water in which these sediments accumulated is called Lake Saline after the Saline River. Comparable and contemporaneous lakes occupied the nearby basins of Skillet, Little Wabash, Big Muddy, and other rivers (fig. 1).

Although the presence of extensive lake plains in southern Illinois and southwestern Indiana had been recognized previously (Fuller and Clapp, 1904), Shaw (1911, 1915) first interpreted the lake plains as having resulted from slackwater lakes caused by the building of Wisconsinan valley trains of glacial outwash in the Ohio and Mississippi Valleys. Many such extinct lakes of various sizes were formed in the tributary valleys in Kentucky and Missouri as well as Indiana and Illinois (Finch, Olive, and Wolfe, 1964; Gray, 1971; Thornbury, 1950; Wayne, 1952, 1958). The presence of deposits of a large Pleistocene lake in the Saline River Basin was noted by Butts (1925), who briefly described the character of the lake sediments. Fidlar (1948) showed that in the Wabash Valley much of the Woodfordian valley train that had caused the lakes in the tributary valleys was eroded by discharge from Lake Maumee. The lake in the Saline River Basin was named Lake Saline and the name Equality Formation was given to the deposits of this and similar lakes (Willman and Frye, 1970).

Field work for this report was done during the summers of 1970 and 1971. The paleontological studies were done by Leonard, and the X-ray mineral analyses were made by Glass.

SUMMARY HISTORY OF LAKE SALINE

Lake Saline was a late Pleistocene impoundment in erosional valleys in the drainage basin of the Saline River and its tributaries. The pre-Illinoian history is obscure, except for the fact that erosional valleys existed nearly to the depth of the present bedrock surface. The glacial history of the Saline Basin consists of the advance of one Illinoian glacier into the basin. The position of the front of this Illinoian glacier is defined by the presence of glacial till on the uplands above the lake level along the north side of the basin (e.g., Omaha North Section), and by the fact that farther south, within the area of the lake, areas or "islands" of high bedrock display a stratigraphy of Yarmouth Soil developed on bedrock, overlain by thin Loveland Silt, which contains a Sangamon Soil in the top. This soil is overlain by a sequence of Roxana Silt and Peoria Loess (e.g., Lawler Northeast Section), thus indicating that glaciers of Illinoian age did not reach as far south as the southern part of the lake basin.

The topography of the drainage basin in Illinoian time was relatively mature; broad bedrock-controlled benches occurred along the major valley sides (e.g., Dale Northwest Section) and the stream channels were not sharply incised (fig. 2). In the northern part of the Lake Saline Basin, gently sloping valley sides are mantled in places with Illinoian till and outwash down to elevations below the level of the major lake plain. In that area Illinoian drift composes a significant

part of the valley fill below deposits of Lake Saline. In the southern part of the lake basin, which lacks glacial drift, the bedrock slopes above the lake plain are generally continuous with the erosional slopes now buried by the lake deposits.

The Sangamon Soil developed over the post-Illinoian topography. This soil is preserved in the Illinoian till in the northern part of the basin and in the bedrock or thin Loveland Silt in the central and southern part of the basin. Although extensive and thick deposits of Illinoian drift underlie the lake deposits in the northern part of the basin, Sangamon Soil has not been observed under the Wisconsinan lake deposits. This relationship implies that, during late Sangamonian or early Wisconsinan time, erosion widely removed the Sangamon Soil from lower

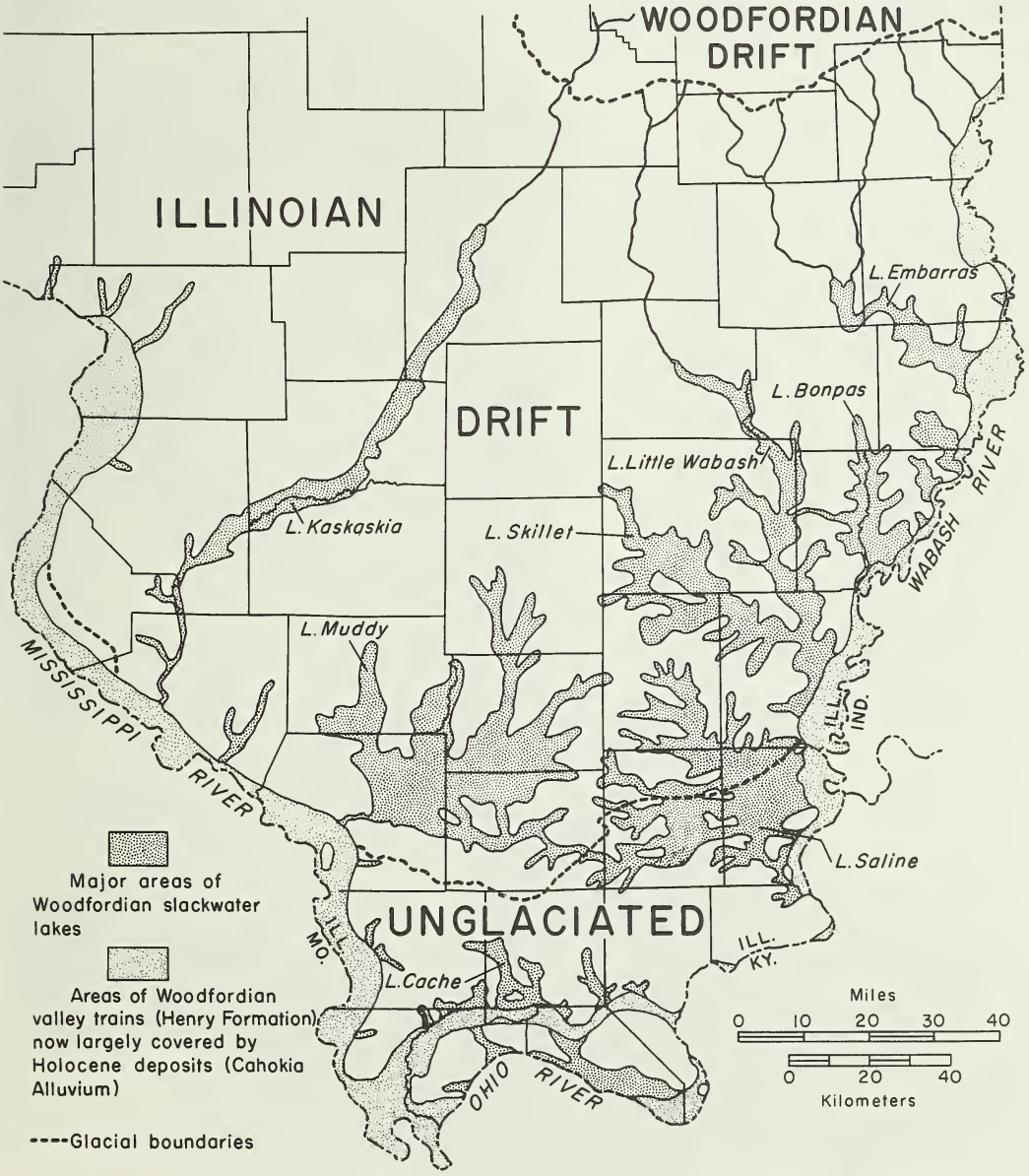


Fig. 1 - Southern Illinois, showing Woodfordian slackwater lakes and valley trains.

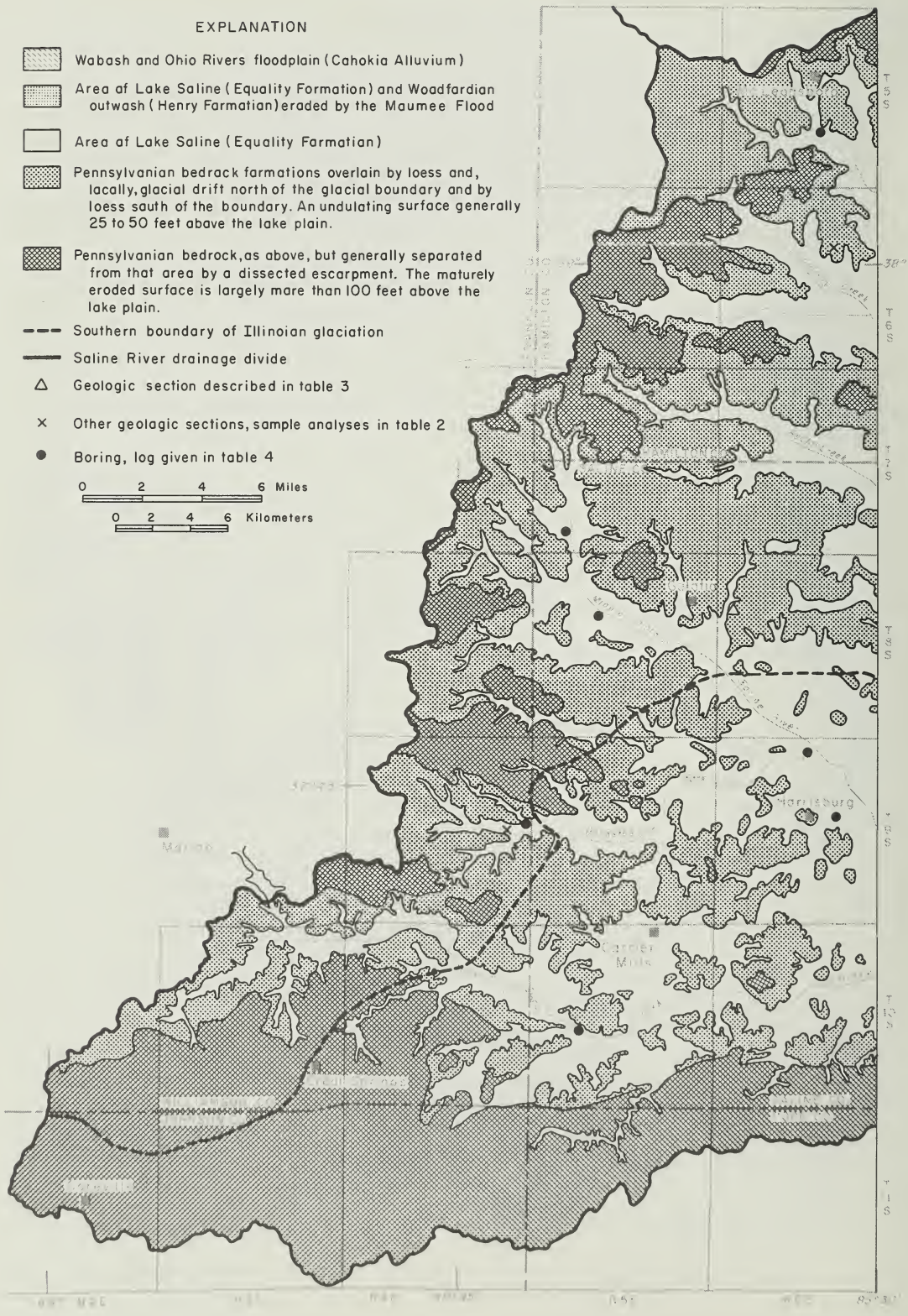
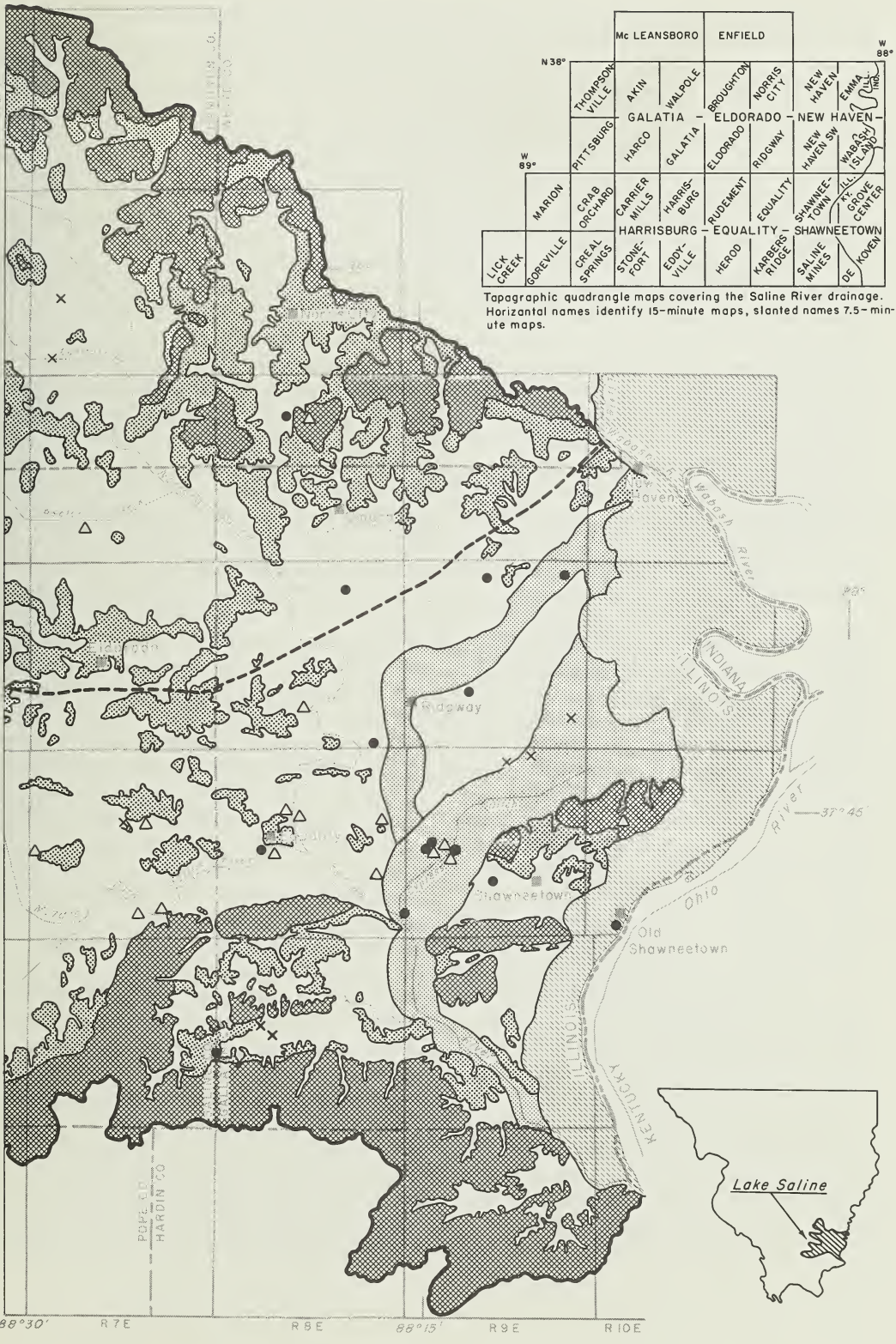


Fig. 2 - Maximum extent of Lake Saline in the Saline



River drainage basin in southeastern Illinois.

valley sides. Streams incised into bedrock and Illinoian drift 100 to 150 feet below the level of the present rivers. Although lakes of Illinoian age are known to have occurred in the western part of the Saline Basin, particularly where the glacier blocked northward-flowing valleys, evidence has not been found for an Illinoian lake in the area of Lake Saline.

Altonian glaciers of the Lake Michigan Lobe certainly discharged some outwash into the drainage system that is now the Wabash. Glaciers also invaded the upper Ohio River Basin during mid to late Altonian time and discharged outwash down the Ohio River. Interpretation of all available data suggests that the outwash from these northern and northeastern glaciers alluviated the master valleys of the Wabash and Ohio Rivers to such an extent that slackwater lakes formed in the valleys of the Saline River Basin. Fine sediments moved from these major outwash-carrying streams into the slackwater lakes. This first silt and clay deposition formed the basal part of the Equality Formation. It is concluded that the major part of the Altonian sediments was derived from outwash carried southward through the Wabash Valley from glaciers of the Lake Michigan Lobe, because they contain slightly more dolomite than calcite (X-ray analyses in counts per second, $< 2\mu$ fraction) in contrast to the sediments of the next younger (Woodfordian) deposition (table 2). Also, the Altonian sediments are more clayey than those of the next episode of slackwater deposits (Saline River and Ridgway West Sections, table 2). The maximum elevation at which the slackwater sediments of Altonian Lake Saline have been observed is approximately 350 feet. The valley train in the Wabash and Ohio Valleys during Altonian time must have reached an elevation above 350 feet to produce the slackwater lake.

Following Altonian alluviation of major glacial drainageways and slackwater deposition in Lake Saline, the major valleys were incised during Farmdalian time and the Farmdale Soil developed on Roxana Loess and uneroded lake deposits. Away from the master stream (e.g., Ridgway West Section), little channel incision occurred and slow deposition of fine sediments derived from the local drainage basin took place. Farther up the tributaries (e.g., Big Ridge Section), similar slow accumulation occurred on the eroded and weathered valley sides cut in Pennsylvanian bedrock. Minor Farmdalian incision (e.g., Equality Northeast Section) also was followed by slow accumulation of noncalcareous sediments, but at some places (e.g., Horseshoe Section) erosion was continuous. At the Saline River Section the Altonian age deposits were weathered and a shallow soil profile developed. The elevation of the Farmdale Soil was not uniform. At positions where deep incision did not occur, the Farmdale surface was at an elevation of about 355 ± 5 feet, but where it had been incised, farther down the valleys, it was as low as 340 to 345 feet and it was even lower in the master streams.

Following valley deepening during Farmdalian time, early Woodfordian outwash (Shelbyville through Illiana Drifts) aggraded the master stream valleys, and a slackwater lake again filled the Saline River Valley system. This lake reached a level of 360 feet shortly after 21,000 radiocarbon years B.P., as attested by the radiocarbon dates at the Big Ridge Section. The lake level continued to rise to an elevation of about 400 feet. This early to middle Woodfordian episode of lacustrine deposition was dominated by sediments from a source in the Huron and Erie glacial lobes. The higher content of calcite than dolomite, together with a typical northeastern clay-mineral assemblage, indicates that the sediment, at least in part, was carried by the Ohio River. That the lake was an open, semipermanent body of cool water is demonstrated by the molluscan faunas.

The early Woodfordian lake flooded tributaries of the drainage basin westward into Williamson County and northward into Hamilton County, and it may have had a temporary connection with a contemporary lake in the Big Muddy drainage system. The lake deposits west of central Gallatin County are predominantly clayey silt or silty clay, but in the narrow tributary valleys sediment derived from erosion of loess and bedrock of the local drainage basin appears to be gradational with deposits carried into the lake from the outwash source.

The termination of this, the most extensive episode of Lake Saline, can be fixed in time only indirectly by the following interpretations: (1) it persisted long enough to develop an extensive lake plain at an elevation ranging from 375 to 385 feet, with local overwash deposits rising another 20 to 30 feet above the main lake plain; (2) although Peoria Loess more than 30 feet thick (the base of the Peoria is dated at 22,000 years B.P.) occurs on uplands surrounded by the lake, Peoria Loess thicker than 2 or 3 feet does not occur on the lake plain; (3) the episode of stream dissection into these highest-level lake deposits was followed by outwash alluviation and low-level lake deposits estimated at 17,500 years B.P. From these considerations it seems a reasonable conclusion that the lake persisted for three or four thousand years but that it persisted at its highest level for not more than 1,000 years including the date of 20,000 years B.P. The absence of wave-cut cliffs, beaches, and other shore features indicates a fluctuating lake level, probably related to the pulsating deposition of outwash in the major valleys. Nevertheless, the uniformity of the lake deposits and the absence of unconformities indicate that the lake was not drained during this interval. The accumulation of the lake sediments effectively drowned the preexisting topography.

The fact that thick Peoria Loess accumulated on upland areas during the time this extensive lake was in existence is evidence that the valley-train outwash, which was the source of the loess, was above lake level and therefore was the dam for the lake. A significant part of the lake sediments may be windblown silt deposited in the lake. The thin loess adjacent to the western part of the lake had a western source in the Mississippi Valley, as shown by its clay-mineral composition, and it contributed only a small increment to the lake deposits except in the narrow tributary valleys.

The high-level phase of Lake Saline was terminated by a mid Woodfordian episode of lowered lake level caused by erosional incision of the major streams. As the channels of the Wabash and Ohio Rivers were lowered through their thick outwash fills, the barrier that had produced the slackwater lake was removed and the exposed lake plain was trenched by newly integrated drainage. The lower course of the Saline River developed as a consequent stream on this lake plain and took its present course to the Ohio River through a narrow gap in the Wildcat Hills southeast of Equality. Although this erosional event cannot be dated with certainty, it appears to coincide with the major glacial retreat between the deposition of the Tiskilwa Till and the Malden Till Members of the Wedron Formation in the Lake Michigan Lobe at about 17,500 ± 1,000 years B.P. The radiocarbon dates at the Little Cypress Ditch Section should be helpful, but unfortunately they are not conclusive (table 1). In any case, the high-level lake was drained because of erosional lowering of the outwash fills in the Wabash and Ohio River Valleys. Although subsequent outwash fills caused lakes to form, the lake did not again attain an elevation as high as the early Woodfordian lake plain.

The third episode of slackwater deposition in Lake Saline resulted from renewed Woodfordian outwash deposition in the Wabash and Ohio Valleys. The erosional scour had cut across the eastern part of the early Woodfordian high-level lake deposits in eastern Gallatin County. The subsequent outwash-related deposits attained a level of 350 to 360 feet. These sediments contain molluscan faunas that indicate a lake of cool, perhaps slowly circulating, water.

Slackwater lakes were ponded in erosional valleys back of the outwash fill and formed the deposits that now underlie a low terrace. As no loess occurs on the surface of the low-terrace deposit, this episode of lake filling followed the deposition of the Peoria Loess. The irregularly elongate lakes received sediments derived primarily from erosion of their local drainage basins (Equality East Section; Equality Old Bridge Section; table 2), as indicated by the lack of carbonate minerals and the similarity in clay-mineral composition to that of weathered Peoria Loess from the western source (table 2).

The second Woodfordian phase of Lake Saline was interrupted by a period of lower water-level that marked the end of outwash deposition. This phase was followed by the last glacier-controlled episode in the Wabash and Ohio Valleys — the discharge of flood waters from Lake Maumee that eroded a surface called the Maumee Terrace in the Wabash Valley approximately 14,000 years B.P. In the area of Lake Saline these flood waters passed both east and west of Shawneetown Hills and produced the distinctive linear topography and eroded surface (New Haven Southwest $7\frac{1}{2}$-minute Quadrangle) in eastern Gallatin County. As the level of the fill produced by the last episode of Woodfordian outwash and that of the erosional surface produced by the Maumee Flood are approximately the same, it is difficult to differentiate them.

Two slightly different interpretations are possible from the available data, which are primarily from the outcrops and borings at Little Cypress Ditch and Cypress Ditch Sections northwest of Junction. In this area the flat surface is about 20 to 25 feet below the level of the early Woodfordian lake plain and at the level of the Maumee Flood Terrace. Here this surface is underlain by 3 feet of fossiliferous sand and silt, dated at about 13,000 years B.P., that contains a mineralogy indicating a local source. Below this is about 10 feet of interbedded sand, silt and clay, and organic-rich silt, fossiliferous in the lower part but leached and showing mineral alteration in the upper part. From the lower part of these sediments three radiocarbon dates ranging from 17,500 to 23,500 years B.P. have been obtained on the organic-rich silts. However, because of the presence of coal fragments in the samples, it is concluded that the true radiocarbon age is as young or younger than 17,500 years B.P. These sediments rest on an erosional surface cut in the early Woodfordian lake deposits.

If the lower sediments are as old as 17,500 years B.P. and if the mineral alteration in their upper part (Cypress Ditch Auger Section No. 1, beds 3, 4) represents a significant interval of weathering, this area was alluviated to about its present level by mid Woodfordian outwash. The Maumee Flood eroded adjacent areas, but at the Cypress Ditch localities, about 13,000 years B.P., it deposited the top 3 feet of sandy sediments and their fauna in persistently cool, circulating water. On the other hand, if the true age of the lower deposits is significantly younger than the 17,500 date and if the mineral compositions are the result of deposition rather than in-situ weathering, these deposits may all be related to the Maumee Flood.

The history of Lake Saline as an open-water lake ended about 13,000 years B.P. Since then, the Ohio and Wabash Rivers have incised their channels and lowered and broadened their floodplains, resulting in a complex alluvial

history. Near the major valleys sand dunes have encroached on the two lake-plain surfaces. Although sand dunes may have been derived in large part from the earlier outwash deposits, they may have been supplemented by sand from Holocene alluvial deposits. The lake plain is still relatively undissected and poorly drained except for extensive stream channel improvement and ditches.

Along all of the tributaries flooded by Lake Saline and on some low areas of the lake plain, deposits of "overwash" occur above the lake sediments. These overwash deposits are noncalcareous and reflect the mineral composition of the weathered surficial deposits of the drainage basin. The fact that their deposition has continued virtually to the present is demonstrated by the "modern" radiocarbon date (table 1) from the Bankston Fork Section. However, their mineral composition is similar to the low-level silty clay terrace fills along the major valleys in western Gallatin County and farther upstream, which suggests a similar source for these two groups of deposits and emphasizes that in some places they may grade into each other.

STRATIGRAPHY

The Saline River Basin was eroded in Pennsylvanian rocks, except for a narrow belt of Mississippian limestones along the Shawneetown Fault in the southern part of the basin (Butts, 1925; Cady, 1919; Willman and others, 1967). Illinoian drift occurs in the northern and western parts of the basin, and loess deposits mantle the bedrock and drift throughout the basin. These materials were the source of some of the sediments in Lake Saline, particularly in narrow branches of the lake (fig. 2).

The Pennsylvanian rocks are sandstone, siltstone, and shale, with minor beds of coal, clay, and limestone. In some areas the resistant sandstones form prominent escarpments and benches. The clay minerals of the Pennsylvanian shales and siltstones are almost entirely illite and kaolinite, with the kaolinite making up nearly half of the clay minerals (table 2). The soils weathered from bedrock materials retain the characteristic high kaolinite content of the bedrock, but in general, more than half of the illite has been altered to expandable clay minerals (table 2).

Deposits of Illinoian Age

Within the area covered by Illinoian glaciers (Leverett, 1899; Wayne, 1958, 1963; Willman and Frye, 1970), the till (Glasford Formation) is rarely more than 25 feet thick and generally is a discontinuous, thin mantle on the mature pre-Illinoian bedrock topography. In a few areas weak morainic topography occurs, and 3 miles west of Norris City a morainic ridge abuts and partly surrounds a high bedrock hill. In many areas till does not occur on top of the bedrock hills. There is little difference in topography between the glaciated and unglaciated areas, and the glacial boundary has been mapped on the occurrence of isolated outcrops of till and erratic boulders. The glacial boundary crosses the northern part of Lake Saline, but its position is not known with certainty (fig. 2) because the boundary is covered by lake sediments. North of the glacial boundary many borings encounter sand and gravel deposits thought to be Illinoian outwash (Pearl Formation) underlying deposits of Lake Saline (table 4).

The clay-mineral composition of the till in the area is strongly affected by weathering. In those rare exposures where the till retains some carbonate minerals, the clay minerals are more than half illite and contain about equal amounts of kaolinite and expandable clay minerals. In the leached till, the percentage of kaolinite sharply increases, illite decreases, and the expandables slightly increase; in the B-zone of the Sangamon Soil, the illite decreases still more and there is a corresponding increase in expandable clay minerals (P-7313). The kaolinite content of the till in this region of maximum Illinoian glacier advance is generally higher than to the north (Willman, Glass, and Frye, 1963) because of the greater contribution from the Pennsylvanian bedrock. Texturally the till is silty and sandy (table 2).

At a few places below till of the Glasford Formation, thin Petersburg Silt has been observed. The Petersburg Silt displays two sharply different mineral compositions (table 2) similar to those noted in other areas. One composition (Omaha North Section), which was derived from outwash from the advancing glacier, is indistinguishable from that of the overlying till. It contains carbonates, the clay minerals are more than half illite, and expandable clay minerals and kaolinite are present in about equal amounts. The other composition (Galatia East Section) contrasts with that of the overlying till in being low in kaolinite and high in expandables. The material having this composition probably was deposited as a loess prior to the advance of the overriding glacier. Its texture is consistent with this origin.

South of the glacial boundary Illinoian deposits are represented by thin Loveland Silt. The Loveland is generally a red, silty clay, leached, and less than 3 feet thick. This unit is thought to be the stratigraphic equivalent of the loessial part of the Petersburg deposited beyond the Illinoian glacial boundary. Because the Loveland Silt is quite thin, it is entirely within the profile of the Sangamon Soil. Its relatively low kaolinite content and high expandable clay content indicate that it is largely derived from loess blown from glacial outwash sediments (table 2). Illinoian silts were also deposited in small proglacial lakes in the northward-flowing valleys in the southwestern part of the Saline River Basin (Lamar, 1925). These sediments occur at levels higher than Lake Saline.

Wisconsinan Loesses

The widespread Roxana and Peoria Loesses mantle virtually all surfaces above the highest level of Lake Saline. Adjacent to the Ohio and Wabash Valleys the loesses are relatively thick (Shawneetown Hills and Lawler Northeast Sections) and were largely derived by eolian transport from a source in the valley trains of these major outwash-carrying valleys (Fehrenbacher, White, Beavers, and Jones, 1965; Fehrenbacher, White, Ulrich, and Odell, 1965; Frye, Glass, and Willman, 1962; Glass, Frye, and Willman, 1968; Leighton and Willman, 1950; Leonard and Frye, 1960; Ray, 1963).

In this area the Roxana Silt is red-brown and has a maximum thickness of about 3 feet. Everywhere the carbonate minerals have been leached. The clay minerals are characterized by a high percentage of expandables, including a high percentage of vermiculite. The Roxana is predominantly silt, but where involved in colluvial movement it contains sand and even some pebbles. Adjacent to the Ohio Valley the Peoria Loess is tan to buff coarse silt, but westward it grades to tan-brown fine silt and clay. It is readily distinguished from the red-brown,

leached, and clayey Roxana Silt below, which was altered by the development of the Farmdale Soil. The Peoria Loess has a maximum thickness of about 35 feet but thins westward to less than 5 feet in the western part of the basin. Calcareous Peoria Loess in Gallatin County is typical of loess previously described along the Ohio and Wabash Valleys (Frye, Glass, and Willman, 1962) and reflects a northeastern source. The predominant clay mineral is illite. The expandable clay minerals are largely vermiculitic. The carbonate minerals are largely dolomite, which may reflect leaching of calcite during and after deposition. Adjacent to the western part of the lake, where the Peoria is thin and leached, a western source is indicated (Glass, Frye, and Willman, 1968) by the high content of expandable clay minerals that consist essentially of montmorillonite (e.g., P-7309; P-7425).

Henry Formation

The Henry Formation (Willman and Frye, 1970) includes deposits of outwash sand and gravel from the Wisconsinan glaciers to the north and northeast (Fidlar, 1948; Thornbury, 1950). These valley-train deposits aggraded the Ohio and Wabash Valleys to a level that caused the ponding of Lake Saline. Although some remnants of Illinoian age outwash may be included in the lower part of the Henry Formation, they have not been identified. The several episodes of outwash fill during the Wisconsinan have not been differentiated, and the deposits are classed as Henry Formation. Adjacent to these major valleys, sand and gravel outwash was carried into the lake basin, and in these areas the Henry Formation is overlapped by the Equality Formation. The Henry Formation is generally a surficial unit (Willman and Frye, 1970), but because of the wide occurrence of lacustrine clays and silts on Woodfordian outwash, the Henry Formation is extended to include the outwash beneath the Equality Formation. The Henry Formation never overlies the Equality Formation. Below the floodplain silts of the Ohio and Wabash Valleys, there is commonly 100 to 150 feet of sand and gravel. The edge of the outwash deposits underlies the lake plain between New Haven and the Shawneetown Hills (wells 8 to 12 of table 4), and the deposits are encountered in wells near Inman (well 3 of table 4). In the marginal zone some tongues of outwash extend into lake deposits and are included in the Equality Formation. The highest level of outwash fill was at an elevation of about 400 feet and is now represented in this area only by small terrace remnants at a few places, such as northwest of New Haven. Post-Woodfordian stream action extensively eroded these deposits in the Ohio and Wabash Valleys and deposited alluvium (Cahokia Alluvium) on the floodplains.

Equality Formation

The Equality Formation (Willman and Frye, 1970) contains the slackwater sediments deposited in Lake Saline (fig. 2) and is of Wisconsinan age (Butts, 1925; Fidlar, 1948; Thornbury, 1950). Most of these deposits are fine textured and are assigned to the Carmi Member. The Dolton Member is represented only by the prominent sand bars in eastern Gallatin County, between Ridgway and Inman (5 miles southwest of New Haven), and by some surface sands on the lower lake plain. The sand dunes that locally occur on the lake plain near Shawneetown are classed as Parkland Sand. The Equality Formation of the Lake Saline Basin is subdivided into six recognizable units. These units will be described separately but are not formally named.

Deposits of Altonian Age

Deposits assigned to an Altonian age are so placed because of their occurrence below the Farmdale Soil. They have been studied at Saline River, Horseshoe, and Ridgway West Sections and have been penetrated by borings, but they have not yielded fossils. These deposits have a clay-mineral composition similar to that of Peoria Loess from a northeastern source; that is, the predominant clay mineral is illite and the expandable clay minerals are largely vermiculitic. In unaltered samples calcite is only slightly less abundant than dolomite (table 2). The color ranges from light red-brown and pink to yellow-tan. Texturally the deposits are predominantly clay but contain minor amounts of silt and virtually no sand (table 2). These data suggest that the source of these sediments was largely from the valley train of the Wabash Valley and included a major contribution from the Lake Michigan Lobe.

Farmdale Soil

In this stratigraphic position there are two contrasting compositions, both lacking carbonate minerals. One of these is produced by weathering in-situ, as illustrated by the soil profile at the Saline River Section and by the redeposited weathered material at Equality Northeast Section. The second was produced by gleying conditions associated with slow deposition and prominent krotovinas (filled animal borings), as illustrated by the Rector Creek and Ridgway West Sections. The weathered materials are characterized by relatively high illite and a moderate amount of expandable clay minerals that are primarily vermiculitic. The gleyed materials, in contrast, are characterized by high amounts of expandables, primarily montmorillonitic, and relatively low amounts of illite. Texturally, both types of material are predominantly silt and clay, with only a few samples showing a significant amount of sand (table 2).

Early Woodfordian Lake Deposits

The highest level of Lake Saline was reached in early Woodfordian time, and the high-level lake plain was formed during this episode of deposition. These deposits underlie the distinctive flat and poorly drained surface, and they originally covered virtually all of the area mapped as Lake Saline in figure 2. The mid to late Woodfordian lake occupied erosional valleys cut below this surface, but these valleys were filled to within a relatively few feet of the high lake-plain surface and are not differentiated on the map (fig. 2). Where the lake plain extends into the tributary valleys, the surface is generally covered by locally derived overwash and only the lower part of the valley fill was deposited in the early Woodfordian lake. Although early Woodfordian deposits have not been demonstrated in all of these tributaries, the lake has been mapped in figure 2 in those areas where the bedrock surface is sufficiently low that lake deposits could be present.

The deposits of this unit are generally weakly bedded silty clay and clayey silt, as described in the Big Ridge, Equality Northeast, Horseshoe, Ridgway West, and Saline River Sections. Locally, the unit includes intervals of well bedded silt and sand that have a lacustrine structure. In eastern Gallatin County the upper part of the unit is sandy (e.g., Lawler Southeast Section). This unit was deposited during the time of major deposition of Peoria Loess along the Ohio and Wabash Valleys. Wind-blown silt fell into the lake, and clay and silt were carried in from the outwash as demonstrated by the high percentages of clay (e.g., P-7364 to P-7391).

Near Harrisburg in central Saline County, many borings show a thick sand bed in the middle of the deposits, but it is not certain whether the sand was locally derived during the Farmdalian erosional episode or is Illinoian outwash.

The color of the early Woodfordian deposits is generally gray to brownish gray. At several localities fossil mollusk shells occur through this unit. At those few places where its base can be defined, this unit appears to be 40 feet or less in thickness. However, many borings (from which samples are not available) suggest that locally it may be much thicker, because the deposits under the high lake-plain surface are as much as 125 feet thick.

The clay-mineral composition of this unit is quite similar to that of the deposits of Altonian age (table 2). The predominant clay mineral is illite and the expandable clay minerals are largely vermiculitic. Where not weathered, the carbonate minerals differ from those of the Altonian deposits in that the calcite content is slightly higher than the dolomite content. This shift in carbonate mineral ratio is interpreted as reflecting a source from the Erie Lobe rather than from the Lake Michigan Lobe.

At one locality (Big Ridge Section) peat and wood fragments occur in a local lens in the lower part of this unit. Radiocarbon dates of 20,600 ± 220 (ISGS-84) and 20,900 ± 140 (ISGS-87) years B.P. confirm the early Woodfordian age of the unit and its stratigraphic position above the Farmdale Soil. Locally these deposits rest either on Farmdale Soil, gleyed deposits of Farmdalian age, eroded lake deposits of Altonian age, deposits of Illinoian age, or Pennsylvanian bedrock. They are generally overlain only by very thin Peoria Loess or by overwash deposits.

Mid to Late Woodfordian Lake Deposits

The episode of early Woodfordian lake deposition that produced the extensive high-level lake plain was followed by erosional deepening of the Ohio and Wabash Valleys, causing draining of the lake and incision of major tributary streams into the deposits underlying the lake plain. After this episode of glacial retreat and erosion at about 17,500 years B.P., renewed outwash alluviation of the Ohio and Wabash Valleys produced slackwater lakes in the tributary valleys and on low areas of the earlier lake plain. Although sharp topographic breaks do not generally occur between these two lake plain surfaces, the lower surface is 10 to 20 feet lower than the higher. Except where there has been channel improvement, the Saline River and its tributaries are not deeply entrenched in this lower surface and it is subject to modern flooding (Smith et al., 1926; Wallace et al., 1969).

West of central Gallatin County these deposits are uniformly clayey silt containing only minor amounts of sand, are weakly bedded to massive, and are tan-gray to light brown in color (Equality East and Equality Old Bridge Sections). The clay-mineral composition of these deposits is similar to that of Peoria Loess from a western source that blankets the uplands of the western and central parts of the lake basin. It contrasts sharply with the clay-mineral composition of the early Woodfordian lake deposits. The clay minerals are predominantly expandables, largely montmorillonitic, and contain a moderate amount of illite; this composition may reflect a source in the leached western-derived Peoria Loess (table 2). Carbonate minerals are generally absent, but secondary calcium carbonate (caliche) is locally abundant.

In eastern Gallatin County outwash of mid Woodfordian age must have been deposited adjacent to the Wabash Valley to a sufficient height to have caused the ponding and the deposition of the clayey silts farther west. However, the evidence is not clear concerning the age of the approximately 10 feet of sediments above early Woodfordian lake deposits and below the low surface (now drained by Cypress Ditch) adjacent to Saline River and west of Shawneetown Hills. These deposits, in strong contrast to the clay facies, consist predominantly of sand. Below the top 4 feet the clay-mineral composition (P-7351; P-7456; P-7469) reflects a northeastern outwash source and includes major amounts of illite and expandable clay minerals, the latter largely vermiculitic. Except for the lowermost samples (table 2), the material is leached of carbonate minerals. The lower part is interbedded with organic-rich silts and contains an abundant fauna of fossil mollusks (Little Cypress Ditch Section and Cypress Ditch Auger Sections Nos. 1 and 2). These data allow two interpretations of origin for the materials below the uppermost 4 feet: (1) they are a remnant of the mid Woodfordian outwash fill of the Wabash Valley that was carried west of the Shawneetown Hills and down the present valley of the Saline River, or (2) the late Woodfordian Maumee Flood, the last glacially controlled event of the Wabash Valley, passed through this area, eroded the surface, and left these deposits. A mid Woodfordian age is suggested by two observations: (1) the uppermost few feet shows a progressive upward increase of expandable clay minerals (P-7351 to P-7355; P-7456 to P-7464), implying soil profile development, and (2) at one locality (Cypress Ditch Auger Section No. 2) an accumulation of organic debris and gleyed material (largely montmorillonite, P-7472 to P-7475) occurs in the top of these sediments. Also, three radiocarbon dates from the Little Cypress Ditch Section may support this age; however, these dates are questionable (table 1). A late Woodfordian age (Maumee Flood) is suggested by the relation of the low surface now drained by Cypress Ditch to the erosional topography that was produced farther up the Wabash Valley by the Maumee Flood.

Late Woodfordian Deposits

The last major discharge of glacial meltwater down the Wabash Valley was from Lake Maumee into the headwaters of the Wabash Basin in northeastern Indiana. The Maumee Flood eroded a broad surface called the Maumee Terrace (Fidlar, 1948; Thornbury, 1950), which beveled earlier outwash deposits. The discharge from Lake Maumee occurred about 14,000 years B.P. (Wayne and Zumberge, 1965). In the Lake Saline area, this terrace surface is only 10 to 15 feet above the floodplain of the Wabash and Ohio Rivers and the Maumee Flood temporarily reached a level at or above the early Woodfordian lake-plain surface. These waters passed through the lowland west of Shawneetown Hills and eroded the lower Saline River Valley. Erosional and depositional features resulting from this event occurred in the two belts shown in figure 2. Bar-like ridges occur in these belts 2 to 3 miles north of Shawneetown Hills and northeast of Ridgway.

In the Cypress Ditch area west of Shawneetown Hills as much as 3 feet of sediment containing abundant fossil branchiate mollusks accumulated on this surface during the declining stage of the flood. Radiocarbon dates show that these deposits and faunas (Cypress Ditch Auger Sections 1 and 2) were accumulating about 13,000 years B.P. They are the uppermost deposits under the lowest lake-plain surface and in the area of Lake Saline are the youngest deposits of the Equality Formation. This thin layer of silty, clayey sand contains only minor

amounts of calcite and dolomite even though it contains abundant mollusk shells. The clay minerals are characterized by a high percentage of expandables, predominantly montmorillonite. This clay-mineral composition is similar to that of the mid to late Woodfordian deposits of Lake Saline and of the weathered, western-derived Peoria Loess that mantles much of the upland surfaces to the west (table 2).

Overwash Deposits

The surficial deposits that veneer the high-terrace surface, particularly along tributary valleys or near high bedrock areas, are predominantly silt containing significant percentages of clay, but they contain some sand and a very minor amount of gravel (Cottage Grove South and Rector Creek Sections). They lack carbonate minerals (table 2). Below the surface soil the clay-mineral assemblages range widely; some samples (e.g., P-7485-87) resemble weathered western-derived Peoria Loess, and others (e.g., P-7342) suggest a mixed source in Pennsylvanian bedrock and western-derived loess. The podzolic surface soil developed on these deposits is low in expandable clay minerals but high in illite, kaolinite, and chlorite-vermiculite (e.g., P-7344; P-7489). Although the deposits are Holocene in age, the soil on these previously weathered materials has the appearance of a strongly developed soil. The slope-wash deposits along tributary valleys grade into Holocene alluvium. These overwash deposits are as much as 20 feet thick along the margins of the lake plain and in some tributaries. They pinch out entirely in some areas of the lake plain, but they occur commonly in low areas (e.g., Rector Creek Section). Although the slope-wash and Holocene alluvium deposits on the lake sediments are more properly classed as Peyton Colluvium and Cahokia Alluvium, they are not separable from the lake beds in this area and are included in the Equality Formation.

PALEONTOLOGY

Molluscan fossils from Lake Saline deposits were first collected from the Saline River Section, the type section of the Equality Formation (Willman and Frye, 1970). Further studies of Lake Saline sediments have resulted in the discovery of other fossiliferous beds of several ages in the Equality Formation and of fossiliferous loess deposits on "islands" in ancient Lake Saline (fig. 3). Habitats vary from offshore (Saline River Section), to nearshore (Horseshoe Section), to shoreline marshes bearing a heavy growth of vegetation (Big Ridge Section).

At least 71 kinds of fossil mollusca and other organisms occur in these beds, but as certain fossil remains are not identified completely because of their immaturity, their fragmentary nature, or other reasons, the total number of taxa represented in Lake Saline deposits is judged to exceed 80. For example, several unidentified species of Pisidium are known to be included, and unidentified species also occur in certain other genera of mollusks. Under ostracods, a variety of taxa are reported as a single item. It is probable that the total number of organisms known from Lake Saline sediments could be further increased by intensive collecting. Because of minimum time for field studies, most collections were made by hand-picking fossils from the outcrop, by bulk sampling, or even by hand-augering (Cypress Ditch Sections and Little Cypress Ditch Section).

Stratigraphic units and described sections (table 3) / Names of fossils	PEORIA LOESS		EQUALITY FORMATION										
			Early Woodfordian lake deposits					Early to mid Woodfordian lake deposits		Mid to late Woodfordian lake deposits			Late Woodfordian lake deposits
	Shawneetown Hills, bed 4	Shawneetown Hills, bed 5	Big Ridge, beds 3, 4, 5	Equality Northeast, beds 8, 9, 10	Horseshoe, bed 2	Ridgway West, bed 4	Saline River, bed 7	Big Ridge, bed 7	Saline River, bed 9	Cypress Ditch No. 1, bed 1	Cypress Ditch No. 2, bed 2	Little Cypress Ditch, beds 1-4	Cypress Ditch No. 1, bed 7
Acella haldemani						●							
Allogona profunda	●	●	●		●	●		●					
*Amnicola gelida**							●			●	●	●	●
*Amnicola leightoni**							●			●	●	●	●
*Amnicola precursor**							●			●	●	●	●
Anguispira alternata		●											
Anguispira kochi		●		●				●	●				
Campeloma sp.*				●									
*Campeloma subsolidum**					●		●					●	●
Carychium exiguum							●						
Chara, nucules of*				●			●					●	
Columella sp.							●						
Deroceras aenigma							●						
Deroceras laeve							●						
Discus cronkhitei	●			●									
Euconulus fulvus	●	●											
Gastrocopta armifera	●												
Gastrocopta contracta		●											
Gastrocopta procera	●												
*Gyraulus altissimus**						●	●					●	
*Gyraulus parvus**			●	●						●	●		●
Gyraulus sp.*							●						
Haplotrema concavum					●								
Hawaiia minuscula				●			●				●		

*Indicates aquatic organism.

Fig. 3 - List of fossils collected from the Peoria Loess and the Equality Formation in the Saline River drainage basin. Figure continued on pages 17 and 18.

Stratigraphic units and described sections (table 3) / Names of fossils	PEORIA LOESS		EQUALITY FORMATION										
			Early Woodfordian lake deposits					Early to mid Woodfordian lake deposits		Mid to late Woodfordian lake deposits			Late Woodfordian lake deposits
	Shawneetown Hills, bed 4	Shawneetown Hills, bed 5	Big Ridge, beds 3, 4, 5	Equality Northeast, beds 8, 9, 10	Horseshoe, bed 2	Ridgway West, bed 4	Saline River, bed 7	Big Ridge, bed 7	Saline River, bed 9	Cypress Ditch No. 1, bed 1	Cypress Ditch No. 2, bed 2	Little Cypress Ditch, beds 1-4	Cypress Ditch No. 1, bed 7
Helicodiscus parallelus	●												
*Helisoma antrosa**				●			●					●	
*Helisoma campanulatum**										●			●
Hendersonia occulta	●	●											
Lampsilis sp.*										●			
*Lymnaea caperata**				●	●	●						●	
*Lymnaea dalli**			●			●						●	
*Lymnaea exile**													
*Lymnaea lanceata**					●	●							
*Lymnaea modicella rustica**				●									
*Lymnaea parva**			●		●		●				●	●	
*Lymnaea reflexa**				●		●							
Lymnaea sp.*							●						
Mesodon appressus		●											
Mesodon clausus	●	●											
Nitella, nucules of*				●								●	
Ostracods, unidentified*				●			●					●	
Physa sp.*						●					●		
*Pisidium compressum**				●			●						
*Pisidium nitidum**					●								
*Pisidium pauperculum**			●							●		●	●
Pisidium sp.*						●				●	●	●	●
*Planorbula armigera**			●	●									
*Planorbula crassilabris**					●	●							

*Indicates aquatic organism.

Stratigraphic units and described sections (table 3) / Names of fossils	PEORIA LOESS		EQUALITY FORMATION										
			Early Woodfordian lake deposits					Early to mid Woodfordian lake deposits		Mid to late Woodfordian lake deposits			Late Woodfordian lake deposits
	Shawneetown Hills, bed 4	Shawneetown Hills, bed 5	Big Ridge, beds 3, 4, 5	Equality Northeast, beds 8, 9, 10	Horseshoe, bed 2	Ridgway West, bed 4	Saline River, bed 7	Big Ridge, bed 7	Saline River, bed 9	Cypress Ditch No. 1, bed 1	Cypress Ditch No. 2, bed 2	Little Cypress Ditch, beds 1-4	Cypress Ditch No. 1, bed 7
*Pleurocera acutum**				●			●			●	●	●	●
*Pleurocera canaliculatum**					●							●	
Pomatiopsis lapidaria	●		●	●	●		●	●			●	●	
*Promenetus exacuous**						●					●	●	
Retinella electrina	●	●			●								
*Sphaerium striatinum**				●			●						
Sphaerium sp.*				●		●					●	●	
Stenotrema hirsutum	●	●											
Stenotrema monodon	●		●	●	●	●			●				
Strobilops labyrinthica	●			●									
Succinea gelida	●	●		●		●	●	●	●				
Succinea grosvenori				●		●							
Succinea ovalis			●		●								
Succinea retusa			●										
Succinea sp.									●				
Unionid shell fragments*							●				●		
Vallonia parvula	●												
*Valvata salina**				●			●			●	●		●
*Valvata tricarinata**				●		●	●			●	●	●	●
Vascular plants, seeds of												●	
Vertigo elatior			●				●						
Vertigo sp.							●						
Viviparus sp.*				●									
Number of species	15	11	11	25	13	16	26	4	4	11	15	21	11

*Indicates aquatic organism.

The known assemblages of fossils attest to at least locally favorable habitats for aquatic mollusca in Lake Saline, that is to say, a lacustrine environment of at least semipermanent nature, containing relatively cool, unsilted water; this interpretation is based on the occurrence of branchiate gastropods that are known to demand such an environment for their survival (Amnicola, Pleurocera, and Valvata).

Although molluscan assemblages in Lake Saline deposits are primarily lacustrine species, faunas from nearshore sediments, such as those at the Horseshoe Section only a few yards from a local bedrock elevation, contain a significant component of terrestrial mollusks. Even those assemblages from offshore localities (Lake Saline Section) almost always contain a few terrestrial shells that must have floated outward from shoreline drift. It is well known that many kinds of empty shells from dead animals may drift for long distances once they are washed into lakes from adjoining land masses. Approximately half of the total known taxa are of terrestrial origin.

Peoria Loess Faunas

In the area of Lake Saline, fossil molluscan faunas have been collected from the Peoria Loess only at The Rocks Section across the Ohio River in Kentucky (Leonard and Frye, 1960) and from the Shawneetown Hills Section. The lowest fauna (bed 4 of Shawneetown Hills Section) is comparable to the basal zone in The Rocks Section that was dated 22,200 years B.P. (table 1). From this zone, 15 species make up the faunal assemblage. All are strictly terrestrial in habitat and all are pulmonate gastropods except Pomatiopsis lapidaria. The varied nature of the fauna is indicated by the fact that of 15 species collected 13 genera are represented; such variety is typical of forest and forest-border gastropod populations. Pomatiopsis lapidaria, an anatomically specialized branchiate gastropod, rarely is found submerged in water and often is found in marshy situations, or pond borders, such as might easily occur on surfaces where loess is being deposited. It is not unusual to find locally in faunal assemblages from loess such genera as Lymnaea (e.g., parva) in moderate abundance where they must have lived near the borders of ponds.

A varied woodland fauna occurs in the upper part (bed 5 of Shawneetown Hills Section) of the Peoria Loess (fig. 3). The assemblage includes 11 species of 9 genera and represents a typical woodland fauna, which includes Anguispira alternata, A. kochi, Euconulus fulvus, Stenotrema hirsutum, and Mesodon appressus. All these species are typically limited to forest habitats. The fauna includes several genera of terrestrial gastropods, such as Gastrocopta, Retinella, and Succinea, which are tolerant of variations in habitats and are capable of living in woodland situations. Hendersonia occulta, very widely distributed in loess faunas from the High Plains to Ohio, is still living but is represented by relict populations. It prefers creek terrace situations, with or without trees, usually in habitats of shrubs and herbs (Van der Schalie, 1939).

Early Woodfordian Faunas

The oldest molluscan faunas from Lake Saline deposits occur in the extensive deposits of early Woodfordian age. The radiocarbon dates at the Big Ridge Section and the stratigraphic relations indicate that these faunas represent

an age range from about 22,000 to 19,000 radiocarbon years B.P. Four of the faunal assemblages were recovered from exposures in the excavated banks of the Saline River at about the same horizon and from similar lithologies. The suite of species differs greatly from one exposure to another, especially in the relative importance of aquatic branchiate, aquatic pulmonate, and terrestrial gastropods. Some of the reasons for this discrepancy seem clear — that is, for example, relation to shoreline — but other factors that must have been of importance are not so easily elucidated. The relative importance of gastropods that demand cool, nonturbid waters is especially noteworthy and seems to indicate that Lake Saline was a fluctuating though relatively permanent body of water. Minor fluctuations produced significant habitat changes near the many miles of shore while little affecting the habitat of deeper water areas. Although the waters seem to have been clear, cool, and relatively permanent in some places, thus supporting faunas of branchiate gastropods (Saline River Section), in others the local environment favored aquatic pulmonates adapted to warmer, silt-laden waters.

Faunas of this age were collected from five described sections (table 3) and are listed in figure 3. The faunas from each of these sections are discussed below.

Big Ridge Section

Eleven species of mollusks are represented in the collection of fossils from this section; the fossiliferous deposits occur largely within a peaty zone exposed in a strip mine pit. Because the exposure is between the horizontal lake beds and a bedrock-supported elevation known as Big Ridge, the habitat is judged to have been a marsh near or at the shore of Lake Saline. Well preserved wood from within the fossiliferous zone has been radiocarbon dated as 20,600 to 20,900 years B.P. (table 1).

The fauna is dominated by Pomatiopsis lapidaria, which occurs by the hundreds. Other species are sparsely represented, except for the two species of Lymnaea, which are slightly more abundant. Among the terrestrial shells, Succinea ovalis and S. retusa are most numerous. The habitat is similar to that of the marshes maintained by artesian waters near Muscotah, in northern Kansas, where Pomatiopsis and Succinea retusa abound. The occurrence of Allogona profunda and Stenotrema monodon attests to a woodland situation, that is, a marshy woodland or woodland border, a concept supported by the abundance of wood in the deposit. Although appropriate methods were used to search for ostracods and for the nucules of Chara, neither were found, but remains of beetles are common.

Equality Northeast Section

This section is one of several important fossiliferous outcrops exposed in the excavated banks of the Saline River; fossils are not greatly concentrated and were collected at appropriate intervals through more than 20 feet of exposure. The fauna, which is varied and seemingly not dominated by one or a few species, comprises 25 taxa, including ostracods and algae. The assemblage is distinctly aquatic in character. Among the 25 taxa, only four represent terrestrial gastropods, and those are exemplified by only a few examples. Branchiate mollusks are represented by Campeloma sp., Pisidium compressum, Pleurocera acutum, Valvata salina, V. tricarinata, and Viviparus. The Equality Northeast Section is

the type locality for Valvata salina (Leonard, 1972), a carinate Valvata resembling tricarinata but more depressed and much larger. This species of Valvata seems unique to Lake Saline; it occurs in fair numbers at five localities in Lake Saline deposits but is not known from other localities in Illinois or elsewhere. Since it is known only as a fossil, its habitat requirements are unknown but may be inferred from its association with V. tricarinata, a species found in clear, cool waters.

Aquatic pulmonate gastropods include Gyraulus parvus, Helisoma antrosa, four species of Lymnaea, and Planorbula armigera — the latter well distributed in Lake Saline deposits and especially numerous in the Horseshoe Section.

This locality seems to have received sediments from a nearby tributary and was more nearly suited to the requirements of aquatic pulmonates than to those of aquatic branchiates. In short, the local environment of the Equality Northeast Section at the time of deposition is difficult to interpret. The wide variety of molluscan species, coupled with the lack of a dominant species or group of species, offers no reliable means for interpretation of the environment.

Horseshoe Section

This exposure in the excavated bank of the modern Saline River is within a few yards of a bedrock upland that was well above the surface of the waters of Lake Saline. The nearshore situation of the deposit is attested to by the presence of several kinds of terrestrial gastropods, well represented numerically, and by a greater abundance of aquatic pulmonates than of branchiates. Terrestrial gastropods include Allogona profunda, Haplotrema concavum, Retinella electrina, Stenotrema monodon, and Succinea ovalis, all predominantly woodland species that must have occurred on the nearby uplands. Pulmonate aquatic gastropods include Lymnaea caperata, L. lanceata, L. parva, and Planorbula crassilabris, all species of shallow, sluggish waters. The nearshore situation of the deposit is also supported by the presence of large numbers of Pomatiopsis lapidaria, a dweller of marshes and wet banks of streams and lakes. Purely aquatic branchiate mollusks include Pisidium nitidum and Pleurocera acutum; neither occurs in large numbers. The faunal assemblage in the Horseshoe Section, like that in Equality Northeast, lacks a truly dominant species assemblage; the most abundant species include Planorbula crassilabris and the other pulmonates. The assemblage lacks any examples of Amnicola, Campeloma, Valvata, and the larger sphaeriids. Pleurocera canaliculatum is less demanding of clear, cool, well oxygenated water than is P. acutum, although precise ecological information is lacking.

Ridgway West Section

Ridgway West, like the Saline River, Equality Northeast, and Horseshoe Sections, is an exposure in the excavated banks of the Saline River. The faunal assemblage changes composition upward through bed 4, with the most abundant shells occurring in the upper one third of bed 4. The upper faunal assemblage comprises 16 species, the lower only half that number.

The lower faunal zone includes only eight species and is clearly dominated by terrestrial gastropods. Only three species of aquatic pulmonates occur, and no branchiate mollusks were found. The lower assemblage suggests a shallow-water deposit near a forest-border terrestrial environment. The matrix contains calcareous nodules, resembling loess kindchen. Certain lower beds contained moss-like markings that seem to be of organic origin.

The upper faunal assemblage is clearly dominated by aquatic pulmonate gastropods, including Acella haldemani, Gyraulus altissimus, Lymnaea caperata, L. dalli, L. lanceata, L. reflexa, Planorbula crassilabris, Promenetus exacuous, and a species of Physa. The sole branchiate gastropod recovered was Valvata tricarinata, and it in small numbers. Four kinds of terrestrial gastropods occur, including Allogona profunda, Stenotrema monodon, Succinea gelida, and S. grosvenori.

Saline River Section

The fauna from the Saline River Section comprises a total of 25 species, of which eight are terrestrial in the strict sense. One species, Pomatiopsis lapidaria, does not ordinarily remain submerged, but it lives in extremely damp situations where there is usually a film of water over its gills. The terrestrial species of mollusks are represented by only one or two examples each, while branchiate snails such as Amnicola gelida, A. leightoni, Pisidium compressum, and Valvata tricarinata are abundantly represented. Pulmonate (air-breathing) aquatic species are represented by a few shells each of such forms as Gyraulus altissimus, a single shell of Gyraulus that probably represents an undescribed species, and a few shells of Helisoma antrosa and Lymnaea parva.

The general faunal picture is that of an assemblage (dominated by branchiate gastropods and sphaeriid pelecypods) that must have lived in cool, clear water. The amnicolids, for example, are abundant in ancient ponds that formed near glacier fronts in the more northerly parts of Illinois (Willman, Leonard, and Frye, 1971). The aquatic pulmonates are so few as to suggest that they were not living at the collecting site, but like the terrestrial shells, floated to the site from elsewhere. The fossils most difficult to account for in these deposits are those of Deroceras, of which there were two kinds. These shells represent internal plates of small slugs that lived in damp situations in woodlands; the plates do not float, even when quite dry.

Early to Mid Woodfordian Faunas

Above the main faunal zone in the extensive early Woodfordian lake deposits, a few meager faunas of fossil mollusks occur in the uppermost calcareous deposits (fig. 3). These upper deposits are not separated from the main faunal zone by an unconformity or by a weathered zone and probably represent the last deposits in the declining early Woodfordian lake. The deposits resemble loess in texture and mineral composition, but their bedding indicates deposition in water.

A silt above the marsh deposits at the Big Ridge Section (bed 7) yielded four species of mollusks: Anguispira kochi, Allogona profunda, Pomatiopsis lapidaria, and Succinea gelida. The silts were water-laid, but the sparse fauna is representative of woodland or woodland-border habitats in a wet environment. At the Saline River Section, silts (bed 9) resembling loess in color and texture contain a meager molluscan fauna. The four species recovered include Anguispira kochi and Stenotrema monodon, both woodland gastropods, and two kinds of Succinea that may also have lived in or near woodlands. The sparse assemblage is one that might be expected in a forest belt alongside a lake or stream.

Mid to Late Woodfordian Faunas

A unit of sandy and silty sediments, from which three faunas were collected, occurs above an erosional unconformity cut deeply into the extensive early Woodfordian lake beds and below the late Woodfordian deposits radiocarbon dated at 13,000 years B.P. (table 1). Because of uncertainty in radiocarbon dates (table 1), the exact age placement is uncertain, but the age falls in the range of 17,500 to 14,000 radiocarbon years B.P.

Cypress Ditch Auger Section No. 1

The fauna from these hand-auger cuttings (bed 1) totals ten species; of these, six are branchiate gastropods, two are pulmonate aquatic gastropods, and two are sphaeriid clams. No terrestrial gastropods were recovered; this fact, plus the predominance of branchiate mollusca, places this fauna in an offshore lake environment. The two species of pulmonate gastropods include Gyraulus parvus and Helisoma campanulatum, neither of which is characteristically found in large open lakes, especially Gyraulus parvus. The only examples of Helisoma campanulatum found in the Lake Saline deposits occur here; campanulatum is a species that lives in small lakes and ponds or in quiet stretches of streams. It is distinctly northern in its present distribution; its type locality is Lake Cayuga, New York.

Cypress Ditch Auger Section No. 2

This fauna (bed 2) comprises 15 species, all of aquatic mollusks with the exception of a single shell of Hawaiia minuscula, a minute terrestrial gastropod probably carried to the site as a drift object. Among the remaining 14 taxa, all are branchiate mollusks except Lymnaea parva (a species that commonly lives on damp earth near water), a species of Physa represented by a few immature shells, and Promenetus exacuous. Because they are not representative of the habitat required by the abundant populations of Amnicola, Pleurocera, and Valvata, these pulmonate gastropods are considered to have been drift specimens. Valvata is represented by salina as well as tricarinata.

Little Cypress Ditch Section

Little Cypress Ditch is an artificial watercourse excavated for drainage purposes. Fossils were obtained from auger borings that began near low-water level (beds 1-4); the hand auger penetrated alternate layers of fine to medium sand and black, unctuous, highly fossiliferous muck. These muck layers (beds 2 and 4) were radiocarbon dated (table 1). The fauna obtained from the Little Cypress Ditch is composed entirely of aquatic species. In addition to nucules of Nitella, seeds of vascular plants including Potamogeton, and a suite of ostracods, the fossils comprise eight species of branchiate gastropods, one kind of Sphaerium, two species of Pisidium, and six kinds of pulmonate gastropods. Thus the fauna is clearly dominated by branchiate mollusks and is complemented by a few pulmonates. The complete absence of terrestrial gastropods is noteworthy and indicates an offshore situation. Although the three species of Amnicola are abundant, it is Pleurocera acutum that is most dominant numerically, indicating clear, cool waters without suspended silt. It is probable that the shells of pulmonate gastropods, relatively sparse in numbers, arrived at the site as drift specimens

from nearshore habitats. The Little Cypress Ditch fauna attests to this phase of Lake Saline being an even better habitat for branchiate mollusks than was the early Woodfordian phase of the lake.

Late Woodfordian Faunas

The molluscan fauna from bed 7 of the Cypress Ditch Auger No. 1 Section comprises 11 species of aquatic mollusks, including 9 branchiates and 2 pulmonates. This is the youngest fauna from the Lake Saline deposits and has been dated at about 13,000 radiocarbon years B.P. (table 1). The fossils are so abundant and the bed is so near the surface that conspicuous numbers have been turned up by plowing in the field adjacent to the auger boring.

The dominant species are in the genera Amnicola, Campeloma, and Pleurocera. Amnicola gelida, A. leightoni, and A. precursor, the three species typical in Lake Saline sediments, exist in large populations, but the most conspicuous elements in the faunal assemblage are Campeloma subsolidum, Pleurocera acutum, and P. canaliculatum, which are extremely numerous. Unfortunately, precise ecological information is lacking for these branchiate gastropods, but it is known that they thrive in relatively cool, clear water (La Roque, 1968). The youngest known occurrence of Valvata salina is in this deposit.

Summary of Paleontology

The faunal assemblages reported are well dated by radiocarbon methods; the span of time embraces an interval from about 22,000 radiocarbon years B.P. (Big Ridge Section) to approximately 13,000 years B.P. (Cypress Ditch Section). If we may judge from stratigraphic and topographic levels of the Lake Saline sediments, the several sections from the excavated banks of the Saline River must represent a time interval at least roughly equivalent to that represented in the Big Ridge deposits, that is to say, 22,000 to 19,000 radiocarbon years B.P. The youngest fossiliferous deposits (Cypress Ditch Sections) are dated at 13,000 radiocarbon years B.P., and two groups of faunas are of intermediate ages between these two, thus spanning most of Woodfordian time.

The span of about 8,000 years between the oldest and youngest faunas is not indicated by faunal differences that can be ascribed to age. Rather, the differences noted among the several faunal assemblages reflect environmental changes in Lake Saline correlated with the progression of geological events and with local differences in habitat such as those produced by offshore or nearshore conditions or by proximity to streams draining into Lake Saline.

The early Woodfordian faunas are the most varied of those from aquatic habitats. These faunal assemblages (with the exception of Big Ridge) are clearly lacustrine in nature. They are dominated by aquatic branchiates, but they all include a few terrestrial gastropods that came from the shore. They also contain pulmonate gastropods of aquatic habit that may be drift specimens in some instances or that may have been functionally part of the local fauna where the situation is nearshore (Horseshoe Section).

The early to mid Woodfordian faunas (Big Ridge Section, bed 7; Saline River Section, bed 9) are in general similar to loess faunas, although very sparse in numbers and therefore difficult to characterize. When these shells accumulated, Lake Saline must have been shallow at these localities.

The mid to late Woodfordian faunas of Lake Saline indicate a clear, cool lake habitat in an offshore situation. These faunas are composed entirely of aquatic gastropods and sphaeriids. Aquatic pulmonates are meagerly represented and seem to have been drift specimens. The dominant feature of these faunas is large populations of branchiate gastropods, including Amnicola gelida, A. leightoni, and A. precursor, which for some reason form a persistent triumvirate. Campeloma subsolidum is a branchiate gastropod of special interest because it frequently burrows in mud but cannot tolerate silted streams or ponds. As late as 1909, Campeloma subsolidum was present in enormous numbers in Wakarusa Creek in eastern Kansas (Hanna, 1909), but with the onset of intensive agriculture, the species became completely extirpated from these waters. Although the habitat requirements of Pleurocera acutum and P. canaliculatum have not been critically studied, it is known that these species require clear, unsilted water and that they thrive best in streams or ponds where the temperature does not rise much above 70 degrees F. Like the branchiates mentioned above, Valvata tricarinata is also a species that lives in clear, cool waters, and is northern in its present distribution. The habitat requirements of V. salina are not known, but because of its association with V. tricarinata, it may be assumed that it demanded a similar ecological setting.

The aquatic pulmonates represented in Lake Saline deposits are in general tolerant of wide fluctuations in local habitat conditions. However, Gyraulus altissimus is associated as a fossil with cold lake faunas, and Helisoma campanulatum is a pulmonate gastropod of northern regions, where it lives in clear, cool waters, although it may be found on mud bottoms.

The molluscan specimens collected in the course of this study are in the paleontological collections of the Illinois State Geological Survey under the collection number ISGS56P.

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TABLE 1 — RADIOCARBON DATES

Lab. no.	Date (Before Present)	Stratigraphic section	Material dated	Location and remarks
ISGS-84	20,600±220	Big Ridge	Wood	SE¼NW¼NW¼ sec. 19, 9 S., 7 E., Saline Co.
ISGS-86	Modern	Bankston Fork	Charcoal flakes	NE¼NW¼NW¼ sec. 24, 9 S., 4 E., Williamson Co.; hearth 2 feet below surface.
ISGS-87	20,900±140	Big Ridge	Peat	SE¼NW¼NW¼ sec. 19, 9 S., 7 E., Saline Co.
ISGS-88	17,510±330	Little Cypress Ditch	Composite of organic muck	NW¼NW¼NW¼ sec. 20, 9 S., 9 E., Gallatin Co.; beds 2 and 4.
ISGS-95	23,500±960	Little Cypress Ditch	Coarse-fraction organic muck	Contained visible fragments of coal; bed 2.
ISGS-96	19,160±690	Little Cypress Ditch	Fine-fraction organic muck	Bed 2.
ISGS-101	12,780±100	Cypress Ditch No. 1	Snail shells	SW¼NW¼NE¼ sec. 20, 9 S., 9 E., Gallatin Co.
ISGS-103	13,030±190	Cypress Ditch No. 2	Clam shell	NW¼NW¼NE¼ sec. 20, 9 S., 9 E., Gallatin Co.
W-867	22,200±450	The Rocks	Snail shells	1 mile SE of Shawneetown bridge, Union Co., Ky.; base of Peoria Loess.

TABLE 2 — CLAY-MINERAL AND GRAIN-SIZE ANALYSES

Stratigraphic section, or location (* = location at end of table)	Sample number	X-ray analyses: Clay minerals (percent)			X-ray analyses: Carbonates (counts/sec.)		Grain-size analyses			
		Expandables	Illite	Chlorite and Kaolinite	Calcite	Dolomite	Gravel (percent)	Matrix (percent): Sand	Silt	Clay
PENNSYLVANIAN ROCKS										
Big Ridge	P-7299	4	50	46	–	–				
SOIL DEVELOPED ON PENNSYLVANIAN ROCKS AND COLLUVIUM										
Cottage Grove SW*	P-7319	32	26	42	–	–				
Cottage Grove SW*	P-7322	24	35	41	–	–				
Barnett Cemetery*	P-7339	33	18	49	–	–				
Lawler NE	P-7345	52	18	30	–	–				
Dale NW*	P-7422	32	19	49	–	–				
Dale NW*	P-7423	42	19	39	–	–				
Dale NW*	P-7424	36	22	42	–	–				
LOVELAND SILT (ILLINOIAN)										
Lawler NE	P-7346	50	28	22	–	–				
PETERSBURG SILT (ILLINOIAN)										
Galatia E	P-7310	60	28	12	–	–				
Omaha N	P-7437	24	51	25	13	–	0	12	54	34
GLASFORD FORMATION (ILLINOIAN) - TILL										
Galatia E	P-7311	26	38	36	–	–				
Galatia E	P-7312	23	45	32	–	–				
Galatia E	P-7313	37	29	34	–	–				
Omaha N	P-7438	23	52	25	–	?	4	30	31	29
Omaha N	P-7439	22	51	27	8	?	8	39	46	25
Omaha N	P-7440	20	46	34	–	–				
Omaha N	P-7441	19	45	36	–	–				
ROXANA SILT (ALTONIAN)										
The Rocks*	P-1079	45	24	31	–	–				
The Rocks*	P-1080	44	30	26	–	–				
New Harmony*	P-1137	46	33	21	–	–				
New Harmony*	P-1138	57	23	20	–	–				
Barnett Cemetery*	P-7340	43	40	17	–	–				
Lawler NE	P-7347	54	23	23	–	–				
Shawneetown Hills	P-7412	45	31	24	–	–	8	8	69	23
PEORIA LOESS - CALCAREOUS (WOODFORDIAN)										
The Rocks*	P-1081	24	53	23	–	10				
The Rocks*	P-1081A	25	51	24	–	26				
The Rocks*	P-1082	26	54	20	–	25				
The Rocks*	P-1083	18	63	19	–	15				
The Rocks*	P-1084	19	63	18	–	15				
The Rocks*	P-1085	15	67	18	–	16				
The Rocks*	P-1086	15	66	19	–	16				
The Rocks*	P-1087	15	68	17	–	16				
The Rocks*	P-1088	14	69	17	–	15				
The Rocks*	P-1089	22	61	17	–	16				
The Rocks*	P-1090	18	63	19	–	12				
The Rocks*	P-1091	24	57	19	–	15				
Lawler NE	P-7348	34	53	13	8	10				
Lawler NE	P-7349	35	54	11	–	6				

TABLE 2 — CONTINUED

Stratigraphic section, or location (* = location at end of table)	Sample number	X-ray analyses: Clay minerals (percent)			X-ray analyses: Carbonates (counts/sec.)		Grain-size analyses			
		Expandables	Illite	Chlorite and Kaolinite	Calcite	Dolomite	Gravel (percent)	Matrix (percent) Sand	Silt	Clay
PEORIA LOESS — CALCAREOUS (WOODFORDIAN), Cont.										
Shawneetown Hills	P-7413	16	62	22	–	22				
Shawneetown Hills	P-7414	13	66	21	–	16	0	0	87	13
Shawneetown Hills	P-7418	30	53	17	–	18				
Shawneetown Hills	P-7419	14	66	20	7	37	0	1	89	10
PEORIA LOESS - LEACHED (WOODFORDIAN)										
Big Ridge	P-7309	73	17	10	–	–				
Galatia E	P-7314	42	25	33	–	–				
Cottage Grove SW*	P-7320	51	33	16	–	–				
Barnett Cemetery*	P-7341	32	23	45	–	–				
Horseshoe	P-7409	51	39	10	–	–				
Shawneetown Hills	P-7415	28	54	18	–	–				
Dale NW*	P-7425	60	24	16	–	–				
Dale NW*	P-7426	59	28	13	–	–				
EQUALITY FORMATION - DEPOSITS OF ALTONIAN AGE										
Saline River	P-7103	21	63	16	23	44	0	1	24	75
Saline River	P-7104	20	67	13	15	37				
Saline River	P-7330	23	59	18	46	56				
Saline River	P-7331	21	63	16	40	43	0	0	38	62
Saline River	P-7332	19	64	17	43	47				
Horseshoe	P-7402	23	63	14	48	56	0	1	45	54
Horseshoe	P-7403	25	62	13	58	66				
Horseshoe	P-7404	27	63	10	48	47	0	0	48	52
Ridgway W	P-7442	7	82	11	21	13	0	0	42	58
Ridgway W	P-7443	18	71	11	13	27	1	2	53	45
Ridgway W	P-7444	13	74	13	13	21				
Ridgway W	P-7445	38	49	13	7	17	0	1	33	66
C-4754* (37½'-60')		11	63	26	10	13				
EQUALITY FORMATION - FARMDALE SOIL AND GLEYED DEPOSITS										
Saline River	P-7105	33	46	21	–	–				
Saline River	P-7106	41	41	18	–	–	0	2	40	58
Big Ridge	P-7300	14	29	57	–	–				
Big Ridge	P-7301	34	26	40	–	–				
Big Ridge	P-7302	65	15	20	–	–	0	4	59	37
Big Ridge	P-7303	66	16	18	–	–				
Rector Creek	P-7315	64	20	16	–	–	0	3	63	34
Rector Creek	P-7316	73	17	10	–	–				
Rector Creek	P-7317	57	22	21	–	–	0	1	61	38
Equality NE	P-7372A	32	49	19	–	–	8	35	35	30
Equality NE	P-7373	35	46	19	–	–				
Equality NE	P-7374	38	46	16	–	–	1	22	49	29
Equality NE	P-7375	38	41	21	–	–				
Equality NE	P-7376	35	45	20	–	–	0	8	59	33
Equality NE	P-7377	33	45	22	–	–				
Equality NE	P-7378	33	46	21	–	–				
Equality NE	P-7379	33	46	21	–	–	0	3	48	49
Equality NE	P-7380	34	49	17	–	–				
Equality NE	P-7381	35	48	17	–	–				
Equality NE	P-7382	32	50	18	–	–				

TABLE 2 — CONTINUED

Stratigraphic section, or location (* = location at end of table)	Sample number	X-ray analyses: Clay minerals (percent)			X-ray analyses: Carbonates (counts/sec.)		Grain-size analyses			
		Expandables	Illite	Chlorite and Kaolinite	Calcite	Dolomite	Gravel (percent)	Matrix (percent): Sand	Silt	Clay
EQUALITY FORMATION - FARMDALE SOIL AND GLEYED DEPOSITS, Cont.										
Equality NE	P-7383	37	44	19	–	–				
Equality NE	P-7384	32	48	20	–	–	0	3	42	55
Ridgway W	P-7446	70	20	10	–	–				
Ridgway W	P-7447	54	29	17	–	–				
Ridgway W	P-7448	69	14	17	–	–	0	1	51	48
Ridgway W	P-7449	54	29	17	–	–				
EQUALITY FORMATION - EARLY WOODFORDIAN DEPOSITS										
Saline River	P-7107	12	77	11	30	28				
Saline River	P-7108	29	60	11	25	17				
Saline River	P-7109	28	63	9	13	10				
Saline River	P-7110	31	59	10	–	11	0	3	53	44
Big Ridge	P-7304	37	40	23	6	10				
Big Ridge	P-7305	13	63	24	12	24	0	1	57	42
Big Ridge	P-7307	15	74	11	24	32				
Big Ridge	P-7308	49	40	11	5	15	0	1	66	33
Equality E	P-7325	44	42	14	18	20				
Equality NE	P-7358	19	66	15	47	53	0	0	39	61
Equality NE	P-7359	21	61	18	35	25				
Equality NE	P-7360	20	60	20	52	38				
Equality NE	P-7361	18	60	22	31	43	0	0	76	24
Equality NE	P-7362	23	60	17	46	41				
Equality NE	P-7363	23	64	13	39	42				
Equality NE	P-7364	21	65	14	21	34	0	0	37	63
Equality NE	P-7365	19	68	13	39	35				
Equality NE	P-7366	17	71	12	40	24	3	2	46	52
Equality NE	P-7367	19	67	14	32	29				
Equality NE	P-7368	16	70	14	30	14				
Equality NE	P-7369	14	74	12	40	12	0	0	44	56
Equality NE	P-7370	14	72	14	39	22				
Equality NE	P-7371	52	38	10	–	–	1	8	48	44
Equality NE	P-7372	48	41	11	–	–				
Equality NE	P-7385	34	49	17	12	21	1	35	34	31
Equality NE	P-7386	31	52	17	22	24				
Equality NE	P-7387	34	52	14	19	24	0	1	46	53
Equality NE	P-7388	20	61	19	45	29				
Equality NE	P-7389	21	62	17	55	46				
Equality NE	P-7390	21	63	16	44	41				
Equality NE	P-7391	20	62	18	64	48	0	0	29	71
Equality NE	P-7392	20	62	18	45	46				
Equality NE	P-7393	19	66	15	55	45				
Lawler SE	P-7394	11	71	18	25	15	0	29	65	6
Lawler SE	P-7395	11	71	18	15	13				
Lawler SE	P-7397	26	62	12	13	30				
Lawler SE	P-7398	54	34	12	13	28	7	7	74	19
Lawler SE	P-7399	58	31	11	23	21				
Lawler SE	P-7400	27	59	14	43	30				
Lawler SE	P-7401	53	35	12	–	–				

TABLE 2 — CONTINUED

Stratigraphic section, or location (* = location at end of table)	Sample number	X-ray analyses: Clay minerals (percent) Expandables	Illite	Chlorite and Kaolinite	Carbonates (counts/sec.) Calcite	Dolomite	Grain-size analyses: Gravel (percent)	Matrix (percent) Sand	Silt	Clay
EQUALITY FORMATION - EARLY WOODFORDIAN DEPOSITS, Cont.										
Horseshoe	P-7405	17	69	14	45	34				
Horseshoe	P-7406	16	72	12	44	35				
Horseshoe	P-7407	18	72	10	50	26				
Horseshoe	P-7408	27	62	11	?	?				
*	P-7420	23	61	16	?	–				
Ridgway W	P-7450	11	76	13	25	24	1	3	50	47
Ridgway W	P-7451	18	70	12	8	–				
Ridgway W	P-7452	19	69	12	26	23	0	1	59	40
Ridgway W	P-7453						0	2	88	10
*	P-7479	11	76	13	44	23	2	2	76	22
C-4754* (13'-37½')		16	61	23	43	27				
EQUALITY FORMATION - MID TO LATE WOODFORDIAN CLAYEY DEPOSITS										
Equality E	P-7326	54	31	15	?	7				
Equality E	P-7327	54	32	14	–	–				
Equality E	P-7328	48	33	19	–	–				
Contrary Creek*	P-7436	53	28	19	–	–	0	5	38	57
Equality Old Bridge	P-7480	56	29	15	–	–	0	8	61	31
Equality Old Bridge	P-7481						0	5	57	38
Equality Old Bridge	P-7482	61	29	10	–	–	0	2	55	43
Equality Old Bridge	P-7483	59	27	14	–	–	0	3	52	45
EQUALITY FORMATION - MID TO LATE WOODFORDIAN SANDY DEPOSITS										
Little Cypress Ditch	P-7351	33	47	20	8	12				
Little Cypress Ditch	P-7352	39	42	19	8	10				
Little Cypress Ditch	P-7353						0	81	7	12
Little Cypress Ditch	P-7354	41	39	20	10	5	0	7	57	36
Little Cypress Ditch	P-7355	60	31	9	–	–				
*	P-7421	40	46	14	–	–	0	86	1	13
Cypress Ditch Auger No. 1	P-7456	37	40	23	–	–	0	40	32	28
Cypress Ditch Auger No. 1	P-7457	37	40	23	–	–				
Cypress Ditch Auger No. 1	P-7458	39	41	20	–	–				
Cypress Ditch Auger No. 1	P-7459	41	45	14	–	–	1	89	2	9
Cypress Ditch Auger No. 1	P-7460	44	45	11	–	–				
Cypress Ditch Auger No. 1	P-7461	53	37	10	–	–				
Cypress Ditch Auger No. 1	P-7462	52	38	10	–	–	0	63	12	25
Cypress Ditch Auger No. 1	P-7463	54	36	10	–	–				
Cypress Ditch Auger No. 1	P-7464	52	38	10	–	–				
Cypress Ditch Auger No. 2	P-7469	43	36	21	–	–				
Cypress Ditch Auger No. 2	P-7470	47	33	20	–	–				
Cypress Ditch Auger No. 2	P-7471	51	30	19	–	–				
Cypress Ditch Auger No. 2	P-7472	67	20	13	–	–				
Cypress Ditch Auger No. 2	P-7473	83	10	7	6	–				
Cypress Ditch Auger No. 2	P-7474	68	20	12	7	–				
Cypress Ditch Auger No. 2	P-7475	69	18	13	–	–				
C-4754* (9'-13')		43	40	17	–	–				

TABLE 2 — CONTINUED

Stratigraphic section, or location (* = location at end of table)	Sample number	X-ray analyses: Clay minerals (percent)			X-ray analyses: Carbonates (counts/sec.)		Grain-size analyses			
								Matrix (percent)		
		Expandables	Illite	Chlorite and Kaolinite	Calcite	Dolomite	Gravel (percent)	Sand	Silt	Clay
EQUALITY FORMATION – LATE WOODFORDIAN DEPOSITS										
Little Cypress Ditch	P-7356	71	21	8	–	11				
Little Cypress Ditch	P-7357	67	23	10	10	–				
Cypress Ditch Auger No. 1	P-7465	47	40	13	–	–	5	46	29	25
Cypress Ditch Auger No. 1	P-7467	54	29	17	6	–	0	54	20	26
Cypress Ditch Auger No. 1	P-7468	48	35	17	7	–				
Cypress Ditch Auger No. 2	P-7476	59	28	13	–	?				
Cypress Ditch Auger No. 2	P-7477	71	19	10	8	6				
Cypress Ditch Auger No. 2	P-7478	57	28	15	–	–				
C-4754* (0-9')		67	21	12	–	–				
EQUALITY FORMATION – OVERWASH										
Rector Creek	P-7318	46	31	23	–	–				
Cottage Grove S	P-7323	39	40	21	–	–	2	12	60	28
Cottage Grove S	P-7324	20	44	36	–	–				
Equality E	P-7329	31	41	28	–	–				
Bankston Fork*	P-7336	20	48	32	–	–				
Bankston Fork*	P-7337						2	3	73	24
Little Eagle Creek*	P-7342	41	38	21	–	–	3	4	72	24
Little Eagle Creek*	P-7343	21	43	36	–	–				
Little Eagle Creek*	P-7344	19	49	32	–	–				
Cottage Grove S	P-7484	54	28	18	–	–				
Cottage Grove S	P-7485	62	30	8	–	–	1	6	59	35
Cottage Grove S	P-7486	61	29	10	–	–				
Cottage Grove S	P-7487	64	26	10	–	–				
Cottage Grove S	P-7488	33	43	24	–	–				
Cottage Grove S	P-7489	19	46	35	–	–	5	7	72	21
Cottage Grove S	P-7490	19	46	35	–	–				

*Location of sections given with described stratigraphic sections (table 3). Locations for sampling positions other than from described sections included with this report are given below.
Bankston Fork, NE¼, NW¼, NW¼ sec. 24, T. 9S., R. 4E., Williamson Co.
Barnett Cemetery, SW¼, NE¼, NW¼ sec. 17, T. 10S., R 8E., Gallatin Co.
Contrary Creek, SE¼, SW¼, NE¼ sec. 31, T. 6S., R. 7E., Hamilton Co.
Cottage Grove SW, NE¼, SE¼, NE¼ sec. 16, T. 9S., R. 7E., Saline Co.
C-4754, NE¼, NE¼, NE¼ sec. 19, T. 9S., R. 9E., Gallatin Co. (See table 4, Gallatin Co., No. 8.)
Dale NW, SW¼, SE¼, SE¼ sec. 10, T. 6S., R. 6E., Hamilton Co.
Little Eagle Creek, SE¼, SW¼, SW¼ sec. 17, T. 10S., R. 8E., Gallatin Co.
New Harmony, SE¼, NW¼, SW¼ sec. 1, T. 5S., R. 14W., Posey Co., Indiana.
P-7420, SE¼, SE¼, NW¼ sec. 3, T. 9S., R. 9E., Gallatin Co.
P-7421, SE¼, NW¼, NW¼ sec. 2, T. 9S., R. 9E., Gallatin Co.
P-7479, NE¼, NE¼, NW¼ sec. 36, T. 8S., R. 9E., Gallatin Co.
The Rocks, 1 mile southeast of Shawneetown bridge, Union Co., Kentucky.

TABLE 3 — STRATIGRAPHIC SECTIONS

Following are 17 described stratigraphic sections. The lithologic sample numbers, preceded by P-, refer to samples in the collections of the Illinois State Geological Survey and are listed in table 2 of this report. The stratigraphic sections are arranged alphabetically by name. Geographic locations of all described stratigraphic sections are shown on figure 2.

BIG RIDGE SECTION

Coal strip pit in lake plain near edge of bedrock upland in SE¼NW¼NW¼ sec. 19, T. 9 S., R. 7 E., Saline County, Illinois (1971).

	Thickness (feet)
Pleistocene Series	
Wisconsinan Stage	
Woodfordian and Farmdalian Substages	
Peoria Loess	
8. Silt and fine sand, leached, dark gray to black at top becoming tan-brown to gray-brown in lower part; surface soil (Modern Soil) at top at level of lake plain surface; poorly developed soil structure (P-7309, 1 foot above base)	3.0
Equality Formation	
7. Silt containing some clay and very fine sand, calcareous, tan to yellow-tan; contains some zones of distinctly bedded fine sand; secondary caliche nodules in upper one-third and a few mollusk shells in lower one-third; massive to thick-bedded (P-7307, 2 feet above base; P-7308, 6 feet above base).	8.0
6. Silt containing sand and local lenses of grit up to 4 mm in diameter, rusty brown, loosely cemented but friable, massive, calcareous; persistent throughout exposed area of pit (P-7306).	0.7
5. Silt, clayey, calcareous, gray and tan, massive; contains mollusk shells (P-7305).	1.5
4. Silt, peaty, and peat, locally abundant wood fragments, brown to dark gray to black, calcareous; contains mollusk shells; (P-7304); occurs as a lens and pinches out along the cut; radiocarbon dates of 20,600 ± 220 (ISGS-84) on wood, and 20,900 ± 140 (ISGS-87) on the peat.	1.0
3. Silt and clay, calcareous, massive, gray to bluish gray; contains abundant mollusk shells.	1.0
2. Silt, clayey, leached to weakly calcareous, gray to blue-gray, generally massive; contains wood fragments in mid-part (Farmdale Soil); a few zones contain sand; in some zones the silty clay is vesicular (P-7300, 1 foot above base; P-7301, 5 feet above base; P-7302, 9 feet above base; P-7303, top).	11.0
Pennsylvanian System	
Carbondale Formation	
1. Shale, weathered, micaceous, blue-gray, sandy and silty, noncalcareous; upper contact is irregular and locally the top ½ foot consists of a weathered rubble of shale fragments; contact with overlying silts is sharp (P-7299, ½ foot below top); (the Brereton Limestone is exposed below the shale, and the Herrin (No. 6) Coal below the limestone is being stripped); thickness of shale above Brereton Limestone.	15.0
Total	41.2

COTTAGE GROVE SOUTH SECTION

Ditch along road in SE¼NW¼NE¼ sec. 15, T. 9 S., R. 7 E., Saline County, Illinois (1971).

	Thickness (feet)
Pleistocene Series	
Wisconsinan and Holocene Stages	
Equality Formation	
5. Silt, and very fine sand, light gray, leached, massive, vesicular; surface soil.	0.5
4. Silt, leached, light gray; contains dispersed brown to black small pellets of Fe-Mn cement that weather out on the surface as granules (P-7490, middle)	1.0
3. Silt, leached, light gray, friable, vesicular, massive; contains pellets of brown iron cement that weather out on the surface as a concentrate (P-7489)	1.5
2. Silt containing some clay, leached, massive, tough, gray; contains tan-brown pellets that weather out on surface (P-7488).	1.0
1. Silt, clayey, leached, massive, brown with mottles of gray and black, plastic; contains very little fine sand; contains large blobs of black Mn-Fe staining (P-7487, top; P-7486; P-7485; P-7484, base).	4.5
Total	8.5

CYPRESS DITCH AUGER SECTION NO. 1

SW¼NW¼NE¼ sec. 20, T. 9 S., R. 9 E., Gallatin County, Illinois (1971).

Thickness (feet)

Pleistocene Series
Wisconsinan Stage
Woodfordian Substage
Equality Formation

7. Sand, silty, calcareous, gray-brown; abundant mollusk shells throughout; radiocarbon date of shells, 12,780 ± 100 (ISGS-101); (P-7468, middle; P-7467, base). 2.0
6. Silt containing some sand, calcareous, gray (P-7466, base). 1.0
5. Silt containing floating sand grains, light gray, noncalcareous except in local spots, compact, brittle, bedded (P-7465). 0.5
4. Sand, silty, clayey, leached, gray, mottled with rusty brown (P-7464, upper; P-7463, lower) 1.5
3. Sand containing some silt and clay, leached, rusty brown, compact (P-7462, top; P-7461, lower). 1.5
2. Sand, loose, noncalcareous, gray, medium-grained at top becoming coarse-grained downward (P-7460, upper; P-7459, middle; P-7458, lower). 2.5
1. Silt containing sand and clay, calcareous, dark gray; contains some fossil mollusk shells throughout (P-7457, upper; P-7456, lower). 2.0

Total 11.0

CYPRESS DITCH AUGER SECTION NO. 2

NW¼NW¼NE¼ sec. 20, T. 9 S., R. 9 E., Gallatin County, Illinois (1971).

Pleistocene Series
Wisconsinan Stage
Woodfordian Substage
Equality Formation

5. Sand, silty, calcareous, tough, tan; becomes dark gray-brown in lower part; contains mollusk shells throughout; radiocarbon date on unionid shell at base, 13,030 ± 190 (ISGS-103) B.P. (P-7476, base; P-7477, 1 foot up; P-7478, 1 foot below top). 3.0
4. Silt, clayey, leached, dark gray, compact; contains wood fragments (P-7475, upper; P-7474, lower). 1.0
3. Sand containing some silt, calcareous in places, gray and tan streaked, loose (P-7473, middle; P-7472, base). . 0.8
2. Sand, calcareous, gray, loose; silty in lower half; fossil mollusk shells throughout, abundant in lower half (P-7471, upper; P-7470, middle; P-7469, base). 3.2
1. Sand, calcareous, loose, gray. . 0.5

Total 8.5

EQUALITY EAST SECTION

Excavated channel bank of North Fork Saline River in SE¼NE¼NW¼ sec. 16, T. 9 S., R. 8 E., Gallatin County, Illinois (1971).

Thickness (feet)

Pleistocene Series
Wisconsinan Stage
Equality Formation

3. Silt and clay, tan-brown, streaked and mottled with dark gray, massive; lower 1 foot weakly calcareous and contains fragments of mollusk shells (P-7329, 1 foot below surface). 4.0
2. Silt and clay, leached, massive to indistinctly bedded, tan, mottled and streaked with light gray and dark gray; lower 3 feet contains irregular caliche platelets; some caliche platelets occur 6 feet above base in noncalcareous silt and clay (P-7326, 5 feet above base; P-7327, 10 feet above base; P-7328, top of unit). 15.0
1. Lower 4 feet covered to bottom of ditch; top 1 foot interzoned pink and gray-tan, clayey, calcareous silt (P-7325, top). 5.0

Total 24.0

EQUALITY NORTHEAST SECTION

Excavated channel bank of North Fork Saline River and auger boring below channel level in NW¼NE¼NW¼ sec. 16, T. 9 S., R. 8 E., Gallatin County, Illinois (1971).

Pleistocene Series
Wisconsinan Stage
Woodfordian and Farmdalian Substages
Equality Formation

12. Silt containing some fine sand and clay, brown, mottled with dark gray and black, leached, blocky (P-7371, base; P-7372, 2 feet up). 5.0
11. Clay, silty, tan-brown, calcareous, blocky; contains nodules and platelets of caliche; upper part browner and containing some fine sand (P-7369, 3 feet above base; P-7370, 4 feet above base) 5.0
10. Silt and fine sand, gray and tan, calcareous, laminated, interbedded with silt and with sand; contains fossil mollusk shells (P-7367, base in laminated silt; P-7368, top in sandy silty clay) 4.0
9. Silty clay and clayey silt, gray to gray-tan, calcareous, blocky to indistinctly bedded; contains sandy streaks, caliche nodules, fossil mollusk shells (P-7366, middle). 4.0

		Thickness (feet)
8.	Silty clay and clayey silt, pink-tan, massive, blocky, calcareous; contains some fossil mollusk shells in lower part (P-7363, 2 feet above base; P-7364, 4 feet above base; P-7365, top).	6.0
7.	Silt containing very fine sand, bedded, calcareous, gray-tan (P-7361, base; P-7362, top).	3.0
6.	Silty clay, pink to pink-tan, calcareous, massive, blocky (P-7360, 2 feet above base).	3.0
5.	Silt, gray-tan, calcareous, indistinctly bedded, loose (P-7359).	2.0
4.	Silty clay, pink to pink-tan, calcareous, massive; top exposed, lower part and beds below penetrated by auger boring (P-7390, 1 foot above base; P-7391, 2 feet above base; P-7392, 3 feet above base; P-7358 and P-7393, top).	4.0
3.	Silt containing some clay, tan, calcareous, massive (P-7388, middle; P-7389, top).	2.0
2.	Silt, clayey, somewhat sandy, pink-tan to brown, calcareous, massive; contains a few charcoal flakes (P-7385, bottom; P-7386, middle; P-7387, top).	3.0
1.	Clay, silty, containing some sand in lower part, tan grading downward to olive-tan and tan-brown, noncalcareous (Farmdale Soil); contains a few fragments of coal in lower part (P-7384 to P-7373, downward from top at 1-foot intervals; P-7372-A, base, ½ foot below P-7373).	11.5
	Total	52.5

EQUALITY OLD BRIDGE SECTION

Excavated bank of Saline River in NW¼NE¼NE¼ sec. 20, T. 9 S., R. 8 E., Gallatin County, Illinois (1971).

Pleistocene Series
Wisconsinan Stage
Equality Formation

1.	Silt, clayey, massive, leached, compact; tan-brown throughout, but brown and black mottling is prominent in top 5 feet, and gray and gray-tan mottling occurs in lower part; small dispersed caliche nodules 4 feet below surface and downward to base; caliche plates and vein filling particularly prominent from 8 feet to 16 feet below surface (these etched plates are not typical soil caliche) (P-7480, 3 feet above water level; P-7481, 11 feet above water level; P-7482, 16 feet above water level; P-7483, 21 feet above water level and 2 feet below surface).	23.0
	Total	23.0

GALATIA EAST SECTION

Roadcuts along Highway 34 in NE¼SW¼SW¼ sec. 7, T. 8 S., R. 6 E., Saline County, Illinois (1971).

		Thickness (feet)
	Pleistocene Series	
	Illinoian Stage	
	Glasford Formation	
3.	Slumped material and spoil from excavation. (Note: roadcut exposures ¼ mile east show 6 feet of Peoria Loess above Sangamon Soil; P-7314, 1½ feet above base of loess)	5.0
2.	Till, leached, brown to tan-brown, material largely derived from Pennsylvanian bedrock; contains few igneous pebbles and some quartz pebbles; jointed, clay skins along joints and on blocky surfaces (P-7311, 2 feet above base); Sangamon Soil at top is red-brown and clayey and contains large areas of black Mn-Fe diminishing downward. (Note: roadcut exposures ¼ mile east show red-brown Sangamon Soil below loess; P-7313, 1 foot below top; P-7312, 15 feet below top)	10.0
	Petersburg Silt	
1.	Silt, leached, gray, mottled with tan and brown, massive (P-7310, ½ foot below top); exposed to bottom of roadcut (Note: nearby gulleys expose Pennsylvanian bedrock a short distance below base of exposure)	3.0
	Total	18.0

HORSESHOE SECTION

Excavated bank of Saline River in SW¼NE¼NW¼ sec. 35, T. 9 S., R. 7 E., Saline County, Illinois (1971); ¾ mile downstream from Saline River Section.

	Pleistocene Series	
	Wisconsinan Stage	
	Woodfordian and Altonian Substages	
	Peoria Loess	
4.	Silt, clayey, leached, gray-brown, massive; top at level of lake plain; spoil pile rests on surface (P-7409, middle)	3.0
	Equality Formation	
3.	Clay, silty, tan-brown, weakly calcareous in lower part but leached in upper part, massive; contains dispersed caliche nodules throughout (P-7408, top)	3.0
2.	Clay, silty, calcareous, massive, blocky, gray to gray-tan; fossil mollusks throughout but particularly abundant in the middle part (P-7405, 3 feet above base; P-7406, 8 feet above base; P-7407, 2 feet below top).	15.0

		Thickness (feet)
1.	Silt, clayey, massive, calcareous, pinkish brown to gray-brown, some mottling with tan; lower 2 feet poorly exposed to water level in Saline River (P-7402, 3 feet above base; P-7403, 4 feet above base; P-7404, 8 feet above base)	10.0
	Total	31.0

LAWLER NORTHEAST SECTION

Roadcuts of Illinois Highway 13 in SE¼SW¼NW¼ sec. 13, T. 9 S., R. 8 E., Gallatin County, Illinois (1971).

Pleistocene Series
Wisconsinan Stage
Woodfordian Substage
Peoria Loess

5.	Silt containing fine sand, leached, brown with some black spots, massive, compact (P-7350, 3 feet above base)	10.0
4.	Silt containing some very fine sand and clay, weakly calcareous, gray with tan streaks, massive but weathers to platy structure, compact (P-7349, top; P-7348, 1½ feet above base)	5.0

Altonian Substage
Roxana Silt

3.	(Farmdale Soil) Silt (loess), leached, brown and gray with rusty brown pellets, platy structure, some iron cementation (P-7347, middle)	2.0

Illinoian Stage
Loveland Silt

2.	(Sangamon Soil) Silt and clay, leached, blocky, compact, reddish brown, mottled and streaked with gray (P-7346, upper part)	2.0

Yarmouthian Stage

1.	(Yarmouth Soil) Clay, silty, sandy, brown and red-brown streaked with gray, tough, compact, blocky; soil developed in Pennsylvanian siltstone, shale, and sandstone; extends to base of exposure (P-7345, upper part)	2.0
	Total	21.0

LAWLER SOUTHEAST SECTION

Roadcut and auger boring in SE¼SW¼SW¼ sec. 24, T. 9 S., R. 8 E., Gallatin County, Illinois (1971).

Pleistocene Series
Wisconsinan Stage
Equality Formation

3.	Sand, silty, leached, brown with small black pellets of Mn-Fe, massive; Modern Soil in top (P-7401, 4 feet below top)	6.0
2.	Silt, sandy, calcareous, tan, massive; a distinct but discontinuous platy caliche zone occurs at top (P-7400, top; P-7399, 1 foot below top; P-7398, base)	2.0
1.	Sand containing some silty zones, calcareous, massive, tan (P-7397, 1 foot below top; P-7396, 2 feet below top; P-7395, 3 feet below top; P-7394, 3½ feet below top)	3.5
	Total	11.5

LITTLE CYPRESS DITCH SECTION

Ditch bank and auger hole in NW¼NW¼NW¼ sec. 20, T. 9 S., R. 9 E., Gallatin County, Illinois (1971).

Pleistocene Series
Wisconsinan Stage
Woodfordian Substage
Equality Formation

7.	Silt, sandy, leached, brown, massive	1.5
6.	Silt, calcareous, gray, mottled with dark gray and brown in upper part; contains caliche nodules in upper 1 foot (P-7356, lower; P-7357, upper)	3.0
5.	Sand, leached, gray grading upward to tan-brown and locally rusty brown at top, indistinctly bedded (P-7355)	2.0
4.	Clay and silt, calcareous, black, massive; contains a small amount of sand; contains fossil mollusk shells (P-7354)	0.3
3.	Sand, tan, calcareous, loose, massive to indistinctly bedded; contains some mollusk shells (P-7353)	1.2
2.	Silt, clayey, containing some sand, calcareous, dark gray to black; contains shells of fossil mollusks (P-7352); radiocarbon dates 17,510 ± 330 (ISGS-88) determined on composite sample of beds 2 and 4; 23,500 ± 960 (ISGS-95) determined on coarse fraction of bed 2 that contained some very small coal fragments; 19,160 ± 690 (ISGS-96) determined on fine fraction of bed 2.	0.5
1.	Sand, calcareous, dark gray to black; contains fossil mollusk shells (P-7351, bottom); in auger hole that penetrated 2 feet below low-water level in ditch	2.0
	Total	10.5

OMAHA NORTH SECTION

Roadcut in NW¼SW¼NW¼ sec. 10, T. 7 S., R. 8 E., White County, Illinois (1971)

Thickness (feet)

Pleistocene Series
Illinoian Stage
Glasford Formation

3. Till, leached, tan-brown, massive, compact; truncated red-brown Sangamon Soil in top (P-7440, 2 feet above base; P-7441, 4 feet above base). . . . 12.0

2. Till, calcareous, tan, massive, compact (P-7438, base; P-7439, top). . . 2.0

Petersburg Silt

1. Silt, sandy, calcareous, tan, massive (P-7437, middle); extends to base in road ditch. 2.0

Total 16.0

RECTOR CREEK SECTION

Excavated bank of Rector Creek in SE¼NW¼SE¼ sec. 29, T. 7 S., R. 7 E., Saline County, Illinois (1971).

Pleistocene Series
Wisconsinan Stage
Equality Formation

3. Silt, leached, massive, gray, mottled with tan and dark gray; contains a few small flecks of caliche in lower part (P-7318, 3 feet below top). . . . 5.0

2. Silt, clayey, leached, gray and tan mottled, massive (Farmdale Soil); contains krotovinas up to 2 inches in diameter filled with gray silt and clay and lined with loosely indurated layer of light brown clay about ¼ inch thick (P-7317, 4 feet above base); a discontinuous zone as much as 6 inches thick of brown, leached, silty sand containing a few grains up to 3 mm in diameter is present 1 foot above base, and the clayey silt, in places, is thin-bedded to laminated above the sand lens. 5.0

1. Silt, clayey, gray with light reddish brown mottling; contains some irregular caliche (P-7316, top; P-7315, bottom of exposure) 2.5

Total 12.5

RIDGWAY WEST SECTION

Excavated bank of Saline River in SE¼NE¼SE¼ sec. 28, T. 8 S., R. 8 E., Gallatin County, Illinois (1971).

Pleistocene Series
Wisconsinan Stage
Woodfordian, Farmdalian, and Altonian Substages
Equality Formation

6. Sand, leached, rusty-brown, massive, silty upward; surface soil in top (P-7455). 4.0

Thickness (feet)

5. Sand, fine, silty, calcareous, massive, gray to gray-tan; contains some small caliche nodules (P-7453, ½ foot below top). 2.0

4. Silt, calcareous, gray, some tan mottling; generally clayey but contains a few zones of silt and fine sand; fossil mollusks throughout but most abundant 4 feet below top (P-7450, 5 feet above base; P-7451, 9 feet above base; P-7452, 11½ feet above base). 12.0

3. Silt, clayey, some zones predominantly clay, leached, tan-brown in lower part grading to gray-brown in upper part (Farmdale Soil); small caliche nodules disseminated throughout; large rusty brown krotovinas prominent in mid-part (P-7445, 1 foot above base; P-7446, 4 feet above base; P-7447, 7 feet above base; P-7448, 10 feet above base; P-7449, top). 11.0

2. Silt, slightly clayey, calcareous, tan-brown with some streaks of gray silt in lower part, mottled gray-tan in upper part; large caliche nodules up to 3 inches in diameter prominent in upper part (P-7443, lower; P-7444; P-7445, top). 6.0

1. Silt, calcareous, light gray, thinly interbedded with massive tan-brown clay; some of the gray silt contains fossil plant impressions (P-7442, upper part); lower part covered to low-water level in river. 6.0

Total 41.0

SALINE RIVER SECTION

Excavated bank of Saline River ditch near bridge in SE cor. SW¼ sec. 27, T. 9 S., R. 7 E., Saline County, Illinois (1970, 1971).

Pleistocene Series
Wisconsinan Stage
Woodfordian, Farmdalian, and Altonian Substages
Equality Formation (type section)

9. Silt, loess-like, brown to tan-brown, massive to indistinctly bedded; leached in upper 4 feet; lower 2 feet calcareous and contains irregular nodules of $CaCO_3$ and a few mollusk shells; top at level of lake plain; sharp contact at base (P-7110, 1 foot above base). . . . 6.0

8. Silt, clayey, calcareous, massive, brown-gray, moderately tough, irregularly blocky (P-7109, middle). . . . 2.0

7. Silt and silty clay interbedded, gray to light gray, calcareous; contains fossil shells of snails and clams (P-7108) 3.0

	Thickness (feet)
6. Clay, silty, calcareous, medium gray-brown, tough, hard, bedded (P-7107)	2.0
5. Silt, clayey, sandy, leached, light yellow-brown, tough, blocky (Farmdale Soil); contains a few small carbonate nodules (P-7106)	2.0
4. Silt containing some very fine sand, leached, dark gray to brown, massive, friable; suggestive of crumb structure of a soil A-zone (P-7105)	1.0
3. Silt, clayey, calcareous, massive, tan-brown at top grading downward to pink-tan at base (P-7104, top; P-7103, base)	6.0
2. From auger boring; silt, clayey, gray, mottled with tan, massive, calcareous (P-7330, 3 feet below top; P-7331, 2 feet below top; P-7332, 1 foot below top)	3.0
1. Slump and overwash to bottom of cut in Saline River	9.0
Total	34.0

SHAWNEETOWN HILLS NORTH AND SOUTH SECTIONS

Composite of sections in roadcuts in SW¼SW¼ NW¼ sec. 17, T. 9 S., R. 10 E., and in NW¼ SW¼SW¼ sec. 17, T. 9 S., R. 10 E., Gallatin County, Illinois (1971).

	Thickness (feet)
Pleistocene Series	
Wisconsinan Stage	
Woodfordian Substage	
Peoria Loess	
6. Loess, leached, coarse, loose; upper half poorly exposed (P-7415, lower)	7 to 10.0
5. Loess, calcareous, coarse, massive, tan; contains fossil snail shells in lower part (P-7418, 1 foot above base; P-7419, 5 feet above base)	20.0
4. Loess, calcareous, massive, tan to light brown, fossiliferous; contains large polygyrid shells that are not present in overlying bed (P-7414, upper part; P-7413, lower part); shells from the base of this unit at The Rocks Section, directly across the Ohio River Valley from Shawneetown, were dated 22,200 ± 450 (W-867) B.P.; partly leached transition zones at bottom	2.5
Altonian Substage	
Roxana Silt	
3. Colluvium of silt containing dispersed chert pebbles, leached, reddish brown grading upward into brown, massive (Farmdale Soil); (P-7412)	1.0
Pliocene–Pleistocene Series	
Mounds Gravel	
2. Gravel of chert and quartz containing well rounded pebbles up to 3 inches in diameter, leached, massive; matrix of red-brown clay and silt fills all interstices (P-7411, ½ foot below top)	3.0
Pennsylvanian System	
1. Shale to bottom of exposure	—
Total	35.0

TABLE 4 - DRILL RECORDS

The following records of 21 borings in the Lake Saline area are selected from several hundred records available in the files of the Illinois State Geological Survey. The locations of the borings listed are shown in figure 2.

GALLATIN COUNTY

1. Water well, near center SW¼SW¼ sec. 2, T. 8 S., R. 8 E., Gallatin Co., Ridgway 7.5-minute Quad. Elevation 385 ft (est.).

Pleistocene Series	
Equality Formation	
35'	Clay, soft
15'	Clay, dark
50'	Clay, blue
	Total 100'
Pennsylvanian System	
	Shale

2. Illinois Division of Highways foundation boring 1-S for box culvert, SW¼SW¼SW¼ sec. 36, T. 8 S., R. 8 E., Gallatin Co., Ridgway 7.5-minute Quad. Elevation 348.5 ft. March 1965.

Pleistocene Series	
Equality Formation	
4'	Silty clay loam, brown
10'	Clay, brown
8.5'	Silty clay, gray
13.5'	Clay with alternate silt loam seams, gray
1'	Silt loam, gray
	Total 37.0'

3. Luhr Bros., Inc. irrigation well, center E. line, SW¼NW¼ sec. 1, T. 8 S., R. 9 E., Gallatin Co., New Haven SW 7.5-minute Quad. Elevation 375 ft (est.). October 1968.

Pleistocene Series	
Henry Formation	
5'	Clay, brown
15'	Sand, fine, brown
5'	Sand, fine to medium, brown
20'	Sand, medium, brown
15'	Sand, medium to coarse, gray
3'	Sand, coarse, gray; contains 1" gravel
2'	Sand, very coarse, gray
5'	Sand, very coarse, gray; contains pea gravel
5'	Sand, very coarse, gray; contains 1/2" gravel
5'	Sand, medium to coarse, gray
5'	Sand, coarse, gray; contains 3/8" gravel
5'	Sand, coarse, gray
	Total 90'
Pennsylvanian System	
1'	Shale, blue

4. Water well, SE cor. SW¼NE¼ sec. 4, T. 8 S., R. 9 E., Gallatin Co., New Haven SW 7.5-minute Quad. Elevation 382 ft (est.). September 1967.

Pleistocene Series	
Equality Formation	
9'	Surface, top soil and clay
5'	Sand, fine, and clay
16'	Mud, blue
11'	Clay, yellow
3'	Mud, blue
4'	Sand, fine, muddy
12'	Mud, blue
4'	Clay, yellow
	Total 64'
Pennsylvanian System	
	Shale

5. E. R. Riggs drill hole, NE¼NW¼NW¼ sec. 28, T. 8 S., R. 9 E., Gallatin Co., New Haven SW 7.5-minute Quad. Elevation 362.2 ft. October 1910.

Pleistocene Series	
Equality Formation	
6'	Soil
29'	Clay and mud
10'	Mud, sandy
20'	Mud
38'	Sand and gravel
10'	Mud, yellow
15'	Sand, yellow
47'	Mud, blue
	Total 175'
Pennsylvanian System	
	Shale

6. Illinois Division of Highways foundation boring 2 for bridge over Saline River, SW¼NW¼ sec. 20, T. 9 S., R. 8 E., Gallatin Co., Equality 7.5-minute Quad. Elevation 337.1 ft. September 1958.

Pleistocene Series	
Equality Formation	
14.1'	Silty clay, mottled
17.5'	Clay, gray
9.4'	Clayey sand, fine, gray
	Total 41.0'
Pennsylvanian System	
5.1'	Shale, gray

7. Bransford Mining Corp. No. 99, NW¼SE¼NE¼ sec. 36, T. 9 S., R. 8 E., Gallatin Co., Equality 7.5-minute Quad. Elevation 345 ft (est.). December 1958.

Pleistocene Series
Equality Formation
5' Clay, soft, brown
27' Sand, unconsolidated
73.5' Clay and sand, soft, gray
Total 105.5'
Pennsylvanian System
Shale, gray

8. Illinois Division of Highways foundation boring 1-S for bridge carrying Baltimore and Ohio Railroad over Little Cypress Branch, NE¼NE¼ sec. 19, T. 9 S., R. 9 E., Gallatin Co., Shawneetown 7.5-minute Quad. Elevation 351.0 ft. June 1965. Core samples C-4754.

Pleistocene Series
Equality Formation
1.5' Clay, brown
7.5' Clay, black to dark gray
4' Sandy clay, brown to gray
22' Clay
1.5' Sand, fine, brown
1' Clay, brown
Henry Formation
12.5' Sand, fine, brown
10.5' Sand, coarse, brown
1' Sandy gravel, brown
Total 61.5'

9. Illinois Division of Highways foundation boring 1 for bridge for SBI 13 over Cypress Branch, NE cor. sec. 19, T. 9 S., R. 9 E., Gallatin Co., Shawneetown 7.5-minute Quad. Elevation 355.8 ft. June 1963.

Pleistocene Series
Equality Formation
1.5' Clay, brown
8' Clay containing sand seams, brown to gray, mottled brown and black
3.5' Sand, fine, poorly graded, brown to gray
4.5' Sand, coarse, poorly graded, gray
24.5' Clay, gray
Henry Formation
2' Sand, fine, well graded, gray
1.5' Sandy clay loam, gray
20' Sand, coarse, poorly graded, brown
12' Sand, coarse, well graded, gray
Total 77.5'

10. Illinois Division of Highways foundation boring 8 for bridge carrying SBI Route 13 over Cypress Ditch, NE¼NW¼ sec. 20, T. 9 S., R. 9 E., Gallatin Co., Shawneetown 7.5-minute Quad. Elevation 350.8 ft. February 1964.

Pleistocene Series
Equality Formation
5' Clay, brown, mottled gray and black
0.5' Sandy clay loam, brown, mottled gray
7' Sand, fine, gray
2.5' Clay loam to sandy clay loam, dark gray
2.5' Sand, medium to fine, dark gray
10' Clay, gray
0.5' Clay to clay loam, gray
9.5' Sand, fine, containing clay seams, brown, mottled gray
2.5' Clay loam, gray
2.5' Sand, fine, containing clay seams, brown
Henry Formation
13.5' Sand, fine, brown
14' Sand, coarse, brown
13' Sand, medium to fine, brown
Total 83.0'

11. Water well, SE¼NE¼NE¼ sec. 28, T. 9 S., R. 9 E., Gallatin Co., Shawneetown 7.5-minute Quad. Elevation 400 ft (est.). July 1967.

Pleistocene Series
Equality Formation
60' Sand, caving
15' Mud, blue
Henry Formation
27' Sand with water
Total 102'

12. Shawneetown City Well No. 1, NW¼SE¼SE¼ sec. 31, T. 9 S., R. 10 E., Gallatin Co., Shawneetown 7.5-minute Quad. Sample set 1762. Described by L. E. Workman. Elevation 350 ft (est.). 1936.

Pleistocene Series
Equality Formation
5' Clay, slightly sandy, brown, limonite-stained
5' Silt and very fine sand, gray, limonite-stained
5' Clay, very sandy, brown
5' Sand, slightly dirty, medium, brownish yellow
Henry Formation
5' Sand, fairly clean, medium to coarse, brownish yellow
5' Sand and gravel, fairly clean, brownish gray; contains pebbles to 1"

5'	Sand and gravel, clean, calcareous, brownish gray; contains pebbles to 1"
5'	Sand, clean, coarse, brownish gray; contains some pebbles
5'	Sand, coarse, gray; contains some pebbles
5'	Sand, medium, gray; contains some pebbles
5'	Sand, very coarse; contains numerous granules and pebbles
5'	Sand, medium to coarse, gray
10'	Sand, medium, gray
2'	No sample
1'	Clay, calcareous, smooth, brownish gray
	Total 73'

13. Illinois Division of Highways foundation boring 1 for bridge carrying FAS Route 902 over Little Eagle Creek, NW¼SW¼ sec. 19, T. 10 S., R. 8 E., Gallatin Co., Equality 7.5-minute Quad. Elevation 395.4 ft. March 1962.

Pleistocene Series

Equality Formation	
4.5'	Silt loam, brown to light brown, mottled brown
3'	Silty loam, gray, mottled brown
2.5'	Sandy clay loam, gray
1'	Silty clay, gray, mottled brown
3.5'	Sandy clay loam containing some gravel, gray to light brown
2.5'	Silty clay, bluish gray
9.5'	Silt loam, gray
3'	Silty clay loam, light brown
3'	Clay loam, light brown
0.5'	Clay loam, gray
4'	Sand, coarse, and gravel, reddish brown
	Total 37.0'
Pennsylvanian System	
3.5'	Sandstone, fine, gray
4'	Sandstone, fine, gray, interbedded with thin seams of gray shale

HAMILTON COUNTY

1. American Coke and Chemical Company boring 12, NW¼NE¼NW¼ sec. 27, T. 5 S., R. 6 E., Hamilton Co., McLeansboro 15-minute Quad. Elevation 406.4 ft.

Pleistocene Series

Equality Formation	
4'	Clay
24'	Clay, sandy
Pearl Formation	
9'	Sand
3'	Clay, gravelly
11'	Sand and gravel
	Total 51'
Pennsylvanian System	
	Shale

SALINE COUNTY

1. Illinois Division of Highways foundation boring 1-S for bridge carrying SBI 143 over Middle Fork Creek, center NW¼ sec. 32, T. 7 S., R. 5 E., Saline Co., Harco 7.5-minute Quad. Elevation 405.5 ft. April 1971.

Pleistocene Series

Equality Formation	
3'	Silty clay loam to sandy loam, brown
2.5'	Silty clay loam, brown, mottled gray
2.5'	Silty clay loam to silty clay, brown, mottled gray
7.5'	Silty clay loam, brown, mottled gray
5'	Silty clay, gray
2.5'	Silty clay loam to silt loam, gray, mottled brown
2.5'	Silty clay, reddish brown, mottled gray
5'	Silty clay containing some rotten wood, gray
5'	Sand, coarse; contains some clay loam seams
5'	Clay to clay loam containing some gravel, gray
	Total 40.5'
Pennsylvanian System	
2'	Clay to clay shale, gray, mottled brown
4.9'	Clay shale, gray

2. Big Creek Coals, Inc. boring 510, SE¼SW¼ SW¼ sec. 9, T. 8 S., R. 5 E., Saline Co., Harco 7.5-minute Quad. Elevation 386.1 ft. January 1920.

Pleistocene Series

Equality Formation	
26'	Clay
Pearl Formation	
25'	Sand
7'	Gravel
2.1'	Sand
	Total 60.1'
Pennsylvanian System	
	Shale

3. Illinois Division of Highways foundation boring 3-S for bridge carrying SBI 143 over Bankston Fork, W. line SW¼NW¼ sec. 3, T. 9 S., R. 6 E., Saline Co., Galatia 7.5-minute Quad. Elevation 358.0 ft. March 1971.

Pleistocene Series
Equality Formation
7.5' Silty clay to clay, brown to dark gray
3' Silty clay to silty clay loam, brown
5' Silty clay, brown, mottled gray
2.5' Silty clay, gray, streaked brown
2.5' Silty clay containing rotten wood and vegetation, gray
2.5' Sand, medium, gray
2.5' Clay loam, gray
2.5' Sandy clay, gray
7.5' Sand, coarse to medium, gray
2.5' Sand, coarse, gray; contains some gravel
2.5' Sand, fine, gray
10' Silty clay to clay, gray
17.5' Clay, gray
2.5' Silty clay, greenish gray
2.5' Clay loam, gray
Total 73.0'
Pennsylvanian System
4.3' Sandstone, greenish gray

4. Illinois Division of Highways foundation boring 1-S for bridge carrying SBI 13 over Pankey Branch, NW¼NE¼SE¼ sec. 15, T. 9 S., R. 6 E., Saline Co., Harrisburg 7.5-minute Quad. Elevation 353.0 ft. June 1969.

Pleistocene Series
Equality Formation
3' Silty clay, dark brown
22.5' Clay, gray, mottled brown
10' Clay, gray
15' Sand, fine, gray
2.5' Silty clay, gray
1' Sand, coarse, brown
11.5' Clay, gray
4.5' Clay containing sand seams, gray
5' Clay, gray, mottled brown
5' Silty sand, gray
Total 80.0'
Pennsylvanian System
5.1' Clay shale, gray

5. Illinois Division of Highways foundation boring 2 for bridge over South Fork Saline River, SE¼SW¼NE¼ sec. 20, T. 10 S., R. 5 E., Saline Co., Carrier Mills 7.5-minute Quad. Elevation 383.9 ft. June 1954.

Pleistocene Series
Equality Formation
2.9' Sandy clay, yellow
3' Clay containing wood fragments, mottled
3' Silt, gray
5' Silty clay, gray and brown
2.5' Sandy clay containing scattered small stones, yellow
3.7' Clay containing scattered small stones, mottled
Total 20.1'
Pennsylvanian System
13.8' Sandstone, light gray

WHITE COUNTY

Byrd and Son boring, NW cor. SE¼NW¼ sec. 9, T. 7 S., R. 8 E., White Co., Norris City 7.5-minute Quad. Elevation 376.7 ft. 1912.

Pleistocene Series
Equality Formation
29' Clay
12' Sand
33' Clay
Pearl Formation
2.5' Sand and gravel
Total 76.5'
Pennsylvanian System
Shale

WILLIAMSON COUNTY

Illinois Division of Highways foundation boring No. 5 for bridge carrying Illinois Central Railroad over FA Route 14, NE¼SE¼ sec. 13, T. 9 S., R. 4 E., Williamson Co., Carrier Mills 7.5-minute Quad. Elevation 412.8 ft. November 1965.

Pleistocene Series
Equality Formation
5' Silty clay loam, brown
7.5' Silty clay, mottled black
5.5' Silty clay containing some gravel, brown, mottled gray
Pearl Formation
4.5' Gravel containing some clay binder, brown to gray
3' Sand, coarse, containing some clay seams, gray
4.5' Gravel containing clay binder, gray
2.5' Silt loam to clay loam containing rotten wood, gray
5' Gravel containing clay loam binder, gray
1.5' Sand, coarse, gray
4' Clay to clay loam, gray; contains some rotten wood and alternate sand seams
4.5' Clay loam, gray
6.5' Sand loam, gray
Total 54.0'
Pennsylvanian System
0.7' Clay shale, very dense, gray

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